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ABSTRACT

This report focuses on the proposals, materials, programs produced, and the results that occur when new teachers and their students become involved with exemplary science materials and with teachers judged to be exemplary. This project enrolled exceptional teachers who could work together in class groups with some common purpose as to science approach or with some purpose peculiar to specific K-12 grade levels. The teachers conducted inservice workshops, wrote articles, prepared curricula, made presentations to organizations, served on committees and as officers in professional societies, and became involved with improvement efforts such as proposals for funding. This report provides general summaries regarding in-school assessment with science, technology and society (STS) initiatives and information from video tapes of teachers prior to and following workshop experience. For each section, generalities and summaries are provided. A separately bound appendix lists participants, a sample of participant products, a sample of feedback questionnaires, newsletters, manuscripts, and STS assessment instruments. In general the results indicated that this project was successful in equipping exemplary teachers with materials and alliances for developing workshops and communication skills. (CW)

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Assessing the Impact of the Iowa Honors Workshop on Science Teachers and Students

A Final Report for NSF

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ASSESSING THE IMPACT OF THE IOWA HONORS WORKSHOP ON SCIENCE TEACHERS AND STUDENTS

Robert E. Yager
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University of Iowa

Final report for National Science Foundation Grant TEI-8317395

ASSESSING THE IMPACT OF THE IOWA HONORS WORKSHOP ON SCIENCE TEACHERS AND STUDENTS

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Foreword

The Iowa Honors Workshop has been a most gratifying experience for the staff and from all accounts the 861 participating science teachers and leaders in science education. Many continuing friendships and much professional dialogue remains as testimony to the success of the effort. An entire report could be prepared based upon the impressions, statements of value, and examples of what happened in the lives of the participants and staff following the workshops. However, this report is meant to be a focus upon more quantifiable outcomes. The assessment of students enrolled in classrooms of the Phase II teachers (teachers who sought to learn about the programs and teaching strategies of the Honors group selected for the summer series) who were enrolled in workshops taught by teachers of exemplary programs. The report focuses upon the efforts to improve science in elementary schools and the move to science/technology/society programs in upper elementary and junior high schools. These efforts represented major departures from the original proposal but were directions that both the NSF staff and the Iowa staff were excited to take.

In one sense this report focuses upon the project as a whole with looks at what was proposed, what happened during the three summers, the materials and programs produced, and the results that occur when new teachers and their students become involved with exemplary science materials and teachers judged to be exemplary. This report does not attempt to summarize nor duplicate the interim reports that were submitted to NSF following the summer activities in 1984, 1985, and 1986.

The effort over a four year period has been a major one. It has affected many students, teachers, and schools. It has involved an ever growing staff as communications and involvement with the scientific and industrial communities have increased.

Although there have been significant changes in NSF staff, philosophy, and direction during the 1984-88 period, this project (Grant #TEI-831-7395) has resulted in many tangible products and many measured improvements. The readers must judge the ultimate significance and impact. Hopefully, this report will provide much direct evidence indicating the success of the program and proper use of NSF funds.

Robert E. Yager
Project Director

Acknowledgments

A project involving such a large staff and so many participants operates efficiently and effectively only when unique circumstances and peoples will it so. The Iowa Honors Workshop was fortunate to have an excellent staff both on the campus and at the satellite centers. The work in Pennsylvania, Florida, Arizona, Wyoming, and Utah was successful because of the coordinators who agreed to head these efforts. The many diverse project officers at NSF provided valuable input and suggestions; in fact, some of them influenced new direction and the assessment efforts in significant ways.

Special thanks are extended to Ronald Bonstetter whose efforts and leadership got the program rolling. After his departure, Joan Tephly became the full time coordinator for the last three years. Her conscientious efforts are in a large way responsible for the final products. The several secretaries associated with the project were essential ingredients in keeping the records, the communication, and the accounting on task. Special thanks is extended to Carolyn Lewis who was involved intimately with the process until all the testing was completed at the end of July, 1986. Dora Thompson stepped in at the end of the funding period to organize and prepare this final support.

To NSF staff, the workshop staff, and all 861 participants, I say thank you for jobs well done. Your involvement made the task of directing the four year effort an enjoyable and rewarding experience.

Robert E. Yager
Project Director

Part I General Information

The Iowa Honors Workshop for Science Teachers was funded in January of 1984, one the first five projects funded by the National Science Foundation as new initiatives in science education were undertaken once again. This action followed the reduction of science education staff at NSF by 90% and the elimination of all supported activity except that which affected graduate training for future scientists. The Iowa program with funds totalling about $1 million dollars operated over a four year period 1984-88.

The Iowa project was conceived as a summer program which enrolled exceptional teachers who would work together in class groups (20-25 each) with some common purpose as to science approach or purpose that was peculiar to specific K-12 grade levels. After such experiences the teachers participating were to become more involved professionally in the following ways:

1) conduct inservice workshops for other teachers;
2) write articles for professional journals concerning their programs and teaching approaches;
3) prepare curriculum modules that could be shared with others;
4) make presentations at state, regional, and national organizations;
5) serve on committees and as officers in professional societies;
6) become involved with improvement efforts, including proposals for external funding.

After the 1981 summer experience the participants were expected to work directly with in-service teachers in their home areas and assist them with implementing new materials and approaches. Directories were produced following each summer workshop which listed workshop topics and leaders who were ready to assist teacher groups and school districts with moves to better science programs and teaching. The workshops conducted by teacher participants included assessment of the success with the implementation efforts the following year. During the 1986-87 academic year the Iowa Honors Workshop moved to work with teacher groups and assessment of the success of the materials and strategies with their students.

A series of tables (1.1 through 1.7) provide general information concerning the number and nature of participants, the extent and nature of feedback from them, and the types of workshop products reported. The rosters of summer participants (the target group for leadership development during the three years) are included as Appendix I. A sample listing of workshop/participant products is included as Appendix II. Such listings are never complete as the teachers enrolled continue production and professional involvement. Also, it is impossible to achieve a total response concerning such listings at any one point in time. Such information is more meaningful immediately after participation for a given summer group (i.e., August-January). Interim reports with information concerning teachers, staff, workshop format, and participant assessment were filed with the NSF program officers each fall following the summer workshop series. These reports (Iowa Summer Honors Workshop Reports, 1984, 1985, and 1986) provide complete information regarding the particular series. The Workshop staff for the summer programs is included as Appendix III. The NSF Program officers associated with the program have been numerous. In addition, their recommendations and directions affected the program considerably since their approval was needed for use of the new funds for each new year. The NSF program officers included:

Theodore L. Reid	1983-84
Alexander J. Barton	1984-85
Mary M. Kohlerman	1985
Jerry H. Bell	1985
Larry O. Hatfield	1985-86
Charles R. Puglia	1986-87
Ethel Schultz	1987-88

Table 1.1 includes a listing of the individual summer workshops, their location, the dates of operation, and the number of teachers/leaders enrolled. The second part of the table also indicates similar information for the Phase II teachers involved during the 1986-87 academic year. In all 390 participants were enrolled during the summers. In addition, another 471 Phase II teachers were enrolled in second level workshops and participated in evaluation with their own students during the 1986-87 year. These activities involved the leadership teachers enrolled during the summer of 1986. Some of the distinctions between the 1986 summer and the 1986-87 academic year phase are not consistent with interim reports because of the confusion of when to tabulate second level workshops if actually conducted during August prior to the beginning of the 1986-87 school year. Of course, the assessment in schools with students occurred during the academic year even though the teacher workshop was held in advance.

Tables 1.2 and 1.3 provide information concerning feedback from the various workshop groups and at different reference points following participation. Appendix IV includes copies of the most complete survey instruments used to gain feedback from participants. It can be seen that the percent providing feedback is higher immediately following a workshop and during the next academic year. Also, extensive feedback (e.g., from the nine page questionnaire) is more difficult to secure than shorter check lists. Nonetheless, telephone surveys revealed that the respondents differ in very small ways to non-respondents--a fact that provides confidence that the results obtained are reliable and reflect patterns for the entire group of participants. In fact, Table 1.3 indicates that in most cases non-respondents who were contacted by telephone were more active and had more products arising from the workshop experiences than did the respondents. Perhaps their greater productivity was a cause of the non-response to lengthy survey forms.

Tables 1.4 and 1.5 provide information regarding the teaching level, gender, and academic degrees for the 390 summer participants. Much more specific information is also available concerning professional involvements, experiences, honors, and other pertinent information on application forms and follow-up surveys. Again, this kind of information is in need of constant up-dating since the participants are/were such active persons professionally. And, the workshops seemed to have stimulated even more activity.

Tables 1.6 and 1.7 provide up-dated information the end of the 1987 academic year regarding products produced by teacher participants during the 1984, 1985, 1986, and the early first semester/1987 time period. The exact figures are computed to provide an indication of likely total effect. There was never any one survey that yielded a complete response. However, as indicated earlier, telephone contacts with samples of non-respondents provided confidence with the accuracy of such projections in numbers of products in each category.

Another aspect of the project was to establish a continuing cadre of professionals who would remain in communication and stimulate new partnerships and collaboration. This aspect of the program certainly became a reality with participants working on hosts of committees, projects, and organizations all over the nation. Reunions have been held each year in connection with the national convention of the National Science Teachers Association. Last year (1987) in Washington, D.C. nearly 200 participants were present for the Iowa Honors Workshop reunion.

Another form of continuing communication is a newsletter series. The Iowa Honors Workshop Newsletter: Focus on Excellence was produced 3 - 5 times per year from the spring of 1984 through the spring of 1987.

The posttesting in schools during the 1986-87 academic year ended the project. During the fall and summer of 1987, only tabulation and processing of the student testing occurred and the preparation of the final report. Appendix V includes sample copies of the Iowa Honors Workshop Newsletter series which was produced and distributed during the 3-1/2 year period.

Other newsletters were initiated in the states where the project was most active. During the last year the emphasis was placed upon Iowa and the STS efforts there. This program continues as a new workshop series and a continuing in-state newsletter. Appendix VI includes samples that illustrate the ties to the Honors Workshop effort.

Generalities

The following summary statements represent the general results of the Iowa Honors Workshop project:

1) Active teachers are available and anxious to be involved in leadership development projects; a total of 390 were involved in the Iowa Honors Workshop;

2) Exceptional teachers can develop skills and interest in heading workshops for other teachers; participants developed on the average

of three such workshops for local, state, and national presentations; each year a handbook was produced and circulated widely as a listing of workshop titles and presenters;

3) Teachers of exceptional programs were able to collaborate and to produce exemplary teaching modules for others to use; each teacher participant in the Iowa workshop was involved on the average with nearly ten such cooperative efforts;

4) Teacher participation found support and expertise in applying for competitive awards, projects, and grants; fifty percent of the teachers who participated in the Iowa program became involved with proposals and grant activity; each participant on the average was recognized twice for excellence by peers and/or professional societies;

5) Exceptional teachers can become proficient as authors of professional manuscripts; such activity can become an important means for communication and recognition; participants in the Iowa Honors Workshop averaged one such manuscript for each participant involved; the results of such preparation of manuscripts are still being observed with more and more being seen in the professional literature.

The general objectives of attracting exceptional teachers, enrolling them in leadership activities, involving them with an exciting staff of science educators and scientists, stimulating continuing association and communication, and encouraging the production of specific professional products were achieved.

TABLE 1.1

PARTICIPANT NUMBERS AND PATTERN OF ENROLLMENT FOR IOWA HONORS WORKSHOP

1984 YEAR I WORKSHOP TITLE		LOCATION OF WORKSHOP	DATES	NUMBER OF PARTICIPANTS
(1)	Science/Technology/Society	Iowa	6/10 - 6/23	31
(2)	Elementary Science	Iowa	6/24 - 7/8	16
(3)	Middle/Junior High Science	Iowa	6/24 - 7/7	22
(4)	Science for the Gifted and Talented	Iowa	7/8 - 7/21	39
(5)	Applications of Science	Iowa	7/8 - 7/21	29
(6)	Leadership	Iowa	6/9 - 6/23	36
			Total	173

1985 - YEAR II WORKSHOP TITLE				
(1)	Science/Technology/Society	Iowa	7/21 - 8/3	31
(2)	Elementary Science	Wyoming	8/4 - 8/17	33
(3)	Middle/Junior High Science	Arizona	7/14 - 7/27	32
(4)	Science for the Gifted and Talented	Pennsylvania	7/14 - 7/27	30
(5)	Applications of Science	Florida	7/7 - 7/20	29
			Total	155

1986 - YEAR III WORKSHOP TITLE				
(1)	Iowa Summer Leadership (STS)	Iowa	6/15 - 6/22	23
(2)	Utah Summer Leadership (STS)	Utah	7/6 - 7/12	12
(3)	Wyoming Summer Leadership (Elementary)	Wyoming	6/7 - 6/11	8
(4)	Florida Leadership (Elementary	Florida	6/25 - 6/30	19
			Total	62

TOTAL FOR ALL THREE SUMMERS 390

1986-1987 ACADEMIC YEAR (LEADERSHIP TEACHERS HEADED WORKSHOPS FOR PHASE II TEACHERS

(1)	IOWA (STS)		
	(a) Storm Lake	9/19-20 and 2/27-28	23
	(b) Springbrook	10/31-11/1 and 5/2-3	24
	(c) Decorah	10/3-4 and 1/30-31	12
	(d) Bettendorf	11/7-8 and 3/13-14	48
		Subtotal	107
(2)	UTAH (STS)		
	(a) Provo	7/14 - 7/19	15
	(b) Ogden	7/14 - 7/19	23
		Subtotal	38
(3)	WYOMING (ELEMENTARY)		
	(a) East Douglas	8/15 - 8/20	25
	(b) Laramie	8/4 - 8/9	28
		Subtotal	53
(4)	FLORIDA (ELEMENTARY)		
	(a) Hillsborough	8/25 - 8/31	230
	(b) Broward	8/15 - 8/31	43
		Subtotal	273
		TOTAL IN FOUR STATES	471

GRAND TOTAL 3 SUMMER LEADERSHIP WORKSHOPS PLUS 1986-1987 ACADEMIC YEAR PHASE II WORKSHOPS	861

TABLE 1.2

PERCENTAGES OF RESPONDENTS PROVIDING EVALUATIVE FEEDBACK FROM VARIOUS CONTACT ATTEMPTS

1984 - YEAR I

WORKSHOP TITLE	A	B	C	D	E
(1) Science/Technology/Society	100	64	42	21	2
(2) Elementary Science	100	76	50	12	1
(3) Middle/Junior High Science	98	54	32	15	1
(4) Science for the Gifted and Talented	92	61	39	23	2
(5) Applications of Science	99	63	38	21	2
(6) Leadership	88	32	0*	64	5
Average Number of Respondents	96	58	34	26	2

*Not Distributed

1985 - YEAR II

WORKSHOP TITLE	A	B	C	D	E
(1) Science/Technology/Society	96	100	58	16	2
(2) Elementary Science	100	86	67	23	2
(3) Middle/Junior High Science	95	77	66	10	2
(4) Science for the Gifted and Talented	83	70	27	15	1
(5) Applications of Science	98	76	52	16	2
Average Number of Respondents	94	82	54	16	2

1986 - YEAR III

WORKSHOP TITLE	A	B	C	D	E
(1) Iowa Summer Leadership (STS)	100	100	70	10	2
(2) Utah Summer Leadership (STS)	100	89	34	16	2
(3) Wyoming Summer Leadership (Elementary)	100	82	25	24	1
(4) Florida Leadership (Elementary)	100	94	74	22	0
Average Number of Respondents	100	91	51	18	1

A = End of Workshop Evaluation Form
B = Periodic Report Forms Distributed by Newsletter
C = Long (9 pages) Questionnaire Distributed to all 390 Participants 1984-1987
D = Short (1 page) Follow-up Questionnaire to Non-Respondents for "C" above
E = Telephone Survey Conducted for Non-Respondents

TABLE 1.3

COMPARISON OF REPORTS OF PROFESSIONAL ACTIVITY BY TEACHER WORKSHOP LEADERS RESPONDING BY QUESTIONNAIRE TO A RANDOM SAMPLE OF NON-RESPONDENTS CONTACTED BY TELEPHONE

ACTIVITY	QUESTIONNAIRE RESPONDENTS*	RANDOM PHONE CONTACTS**
Workshop Presentations	8.3	11.1
National Offices/Presentations	4.6	5.3
Articles Written	3.2	2.8
Curriculum Module Development	8.0	7.3
Teacher Awards	1.5	2.2

*Expressed as average number per participant
**Random sample contacted by telephone interviews

TABLE 1.4

PRIMARY LEVELS OF TEACHING EXPERIENCE FOR SUMMER WORKSHOP PARTICIPANTS

YEAR I

TEACHING LEVEL	(n=31) STS*	(n=16) ELEM*	(n=22) M/JR HIGH*	(n=39) GAT*	(n=29) AP/SCI*
(1) Elementary	12.9	93.8	4.5	17.9	31.0
(2) Middle School	29.0	0	95.5	25.6	27.6
(3) High School	58.1	0	0	46.2	34.5
(4) College	0	6.2	0	2.6	6.9
(5) Other	0	0	0	7.7	0

YEAR II

TEACHING LEVEL	(n=31) STS*	(n=33) ELEM*	(n=32) M/JR HIGH*	(n=30) GAT*	(n=29) AP/SCI*
(1) Elementary	3.2	63.6	3.1	26.7	13.8
(2) Middle School	38.7	9.1	87.5	26.7	34.5
(3) High School	45.2	12.1	6.3	43.3	51.7
(4) College	3.2	0	0	0	0
(5) Other	9.7	15.2	3.1	3.3	0

YEAR III

TEACHING LEVEL	(n=23) IOWA STS* LEADERSHIP	(n=12) UTAH STS* LEADERSHIP	(n=8) WYOMING ELEM* LEADERSHIP	(n=19) FLORIDA ELEM* LEADERSHIP
(1) Elementary	43.5	8.3	96.2	94.4
(2) Middle School	39.1	91.6	3.8	5.3
(3) High School	17.4	0	0	5.3
(4) College	0	0	0	0
(5) Other	0	0	0	0

*STS: Science/Technology/Society
*ELEM: Elementary
*M/JR HIGH: Middle/Junior High School
*GAT: Gifted and Talented
*AP/SCI: Applications of Science

TABLE 1.5

HIGHEST DEGREES EARNED BY TEACHER WORKSHOP LEADERS IN TERMS OF PERCENT OF THE TOTAL PARTICIPANTS

YEAR I	(n=31) STS*	(n=16) ELEM*	(n=22) M/JR HIGH*	(n=39) GAT*	(n=29) AP/SCI*
(1) Bachelor Degree	71.0	56.3	41.0	10.3	37.9
(2) Master Degree	19.4	43.7	50.0	87.2	55.2
(3) Specialist Degree	3.2	0	4.5	2.5	0
(4) Doctoral	6.4	0	4.5	0	6.9
Male	54.8	25.0	50.0	48.7	55.2
Female	45.2	75.0	50.0	51.3	44.8

YEAR II	(n=31) STS*	(n-33) ELEM*	(n=32) M/JR HIGH*	(n=30) GAT*	(n=29) AP/SCI*
(1) Bachelor Degree	25.8	15.2	25.0	23.3	20.7
(2) Master Degree	61.3	78.8	90.6	73.3	72.4
(3) Specialist Degree	9.7	0	0	0	6.9
(4) Doctoral	3.2	6.0	3.1	3.4	0
Male	48.4	45.4	40.6	36.7	48.3
Female	51.6	54.5	59.4	63.3	51.7

YEAR III	(n=23) IOWA STS* LEADERSHIP	(n=12) UTAH STS* LEADERSHIP	(n=8) WYOMING ELEM* LEADERSHIP	(n=19) FLORIDA ELEM* LEADERSHIP
(1) Bachelor Degree	56.5	33.3	69.8	42.1
(2) Master Degree	43.5	58.3	30.2	59.9
(3) Specialist Degree	0	0	0	0
(4) Doctoral Degree	0	8.4	0	0
Male	65.2	83.3	26.4	5.3
Female	34.8	16.7	73.6	94.7

*STS:	Science/Technology/Society
*ELEM:	Elementary
*M/JR HIGH:	Middle/Junior High School
*GAT:	Gifted and Talented
*AP/SCI:	Applications of Science

TABLE 1.6

NUMBER OF PROFESSIONAL ACTIVITIES REPORTED BY WORKSHOP PARTICIPANTS

WORKSHOP TITLE	WORKSHOP PRESENTATIONS	NATIONAL OFFICES/ PRESENTATIONS	ARTICLES WRITTEN PER TEACHER	CURRICULUM MODULES DEVELOPED	AWARDS RECEIVED
YEAR I					
(1) Science/Technology Society	12.6	6.3	2.0	8.0	2.3
(2) Elementary Science	8.8	9.1	2.2	7.3	3.0
(3) Middle/Junior High School	11.1	9.5	2.8	7.8	2.0
(4) Science for the Gifted & Talented	9.5	6.3	1.5	7.8	2.2
(5) Applications of Science	10.5	7.0	6.0	5.6	1.0
Average for total number of participants	10.5	7.6	2.9	7.3	2.1
YEAR II					
(1) Science/Technology Society	8.0	4.3	4.0	6.8	1.8
(2) Elementary Science	14.5	9.8	5.8	15.5	2.3
(3) Middle/Junior High School	15.2	6.0	2.5	7.0	2.8
(4) Science for the Gifted & Talented	8.3	5.7	1.0	4.8	1.8
(5) Applications of Science	9.0	4.7	2.3	6.5	1.9
Average for total number of participants	11.0	6.1	3.1	8.1	2.2
YEAR III					
(1) Iowa Leadership (STS)*	10.4	4.7	4.0	7.3	1.0
(2) Utah Leadership (STS)*	4.8	4.3	1.1	2.0	1.3
(3) Wyoming Leadership (Elementary Science)	5.3	3.6	1.0	4.4	1.4
(4) Florida Leadership (Elementary Science)	6.0	5.3	1.3	6.5	2.3
Average for total number of participants	5.4	4.5	1.9	5.1	1.5

* Science/Technology/Society

TABLE 1.7

TOTAL NUMBER OF VARIOUS TYPES OF PROFESSIONAL PARTICIPATION REPORTED BY SUMMER WORKSHOP TEACHERS

	1984 PARTICIPANTS	1985 PARTICIPANTS	1986 PARTICIPANTS
National Offices/Presentations	959	930	535
Articles Written	411	465	214
Submitted for Publication	115	142	72
Published	132	118	80
Workshops Developed	380	334	137
Total Number Workshops Presented	1507	2170	642
Average Frequency Per Workshop	4.0	6.5	4.7
Curriculum Modules Developed	1096	1240	535
Teacher Awards	274	310	214
Reports or Scientist/Engineer Contacts	281	342	122
Grant Activity	58	94	72

*Totals projected from questionnaire respondent averages

Part II In-School Assessment at the Elementary Level

Year 3 of the Iowa Honors Workshop was very different from the preceding two years in that the summer participants were encouraged to head Phase II workshops in their local districts and/or regions of their states for teacher groups interested in adapting and implementing their model curricula in their classrooms. Two pilot projects were conducted in each of two states for two elementary programs and two state efforts to implement STS materials and strategies. One elementary school program occurred in Florida where leader teachers had been instructed in developing two programs that were recognized nationally as exemplary by the National Science Teachers Association (NSTA). These two programs were Broward and Hillsborough Counties. There was great interest in helping these exemplary programs become general ones for all schools and classrooms in the two respective county districts. The other elementary school effort occurred in Wyoming where the East Douglas program had also achieved recognition as a national exemplar--again by NSTA. In this case the science consultant for the state expressed interest in helping spread the exemplary program at East Douglas to other elementary schools in the state.

The leaders in both states were selected by the NSTA designation of the programs as exemplary. The school staff involved with the exemplary programs became the lead teachers. Hence the leadership training concentrated on how these lead teachers could be effectively involved in enlarging the team and involving more with the program and its further evolution. In the case of Florida, supervisors in the two counties were leaders in identifying new teachers, 230 in the case of Hillsborough and 43 in the case of Broward. Support and encouragement were given for involvement in the Phase II workshop. In the case of Wyoming, the state science consultant "advertised" the possibility of Phase II workshops. Two such workshops were established--one held in East Douglas for 25 teachers for nearby schools and a second held in Laramie for 28 other teachers.

The staff for these Phase II workshops were headed by the supervisors in the two county districts in Florida, Dr. Robert Fronk of Florida Institute of Technology who had headed previous workshop activities in Florida, and Dr. Joan Tephly of the Iowa staff. Drs. Alan McCormack and Joseph Stepans of the University of Wyoming faculty and Dr. William Futrell of the State Department of Education in Wyoming joined Dr. Robert Pesicka and his East Douglas teachers in heading the Wyoming workshops. Drs. Robert Yager and Joan Tephly represented the University of Iowa and assisted with instruction.

In a sense the objectives were met as all Phase II teachers implemented the new programs and approaches during the 1986-87 academic year. The feedback from the Phase II teachers was generally favorable.

One aspect of their work was testing at least one section of students involved with the new materials and approaches. Several facets of the assessment remained with the in-state and local staff. Other pilot studies were conducted on a volunteer basis and are not included in this report. Two facets of the assessment effort were general ones for all teachers and their students in Florida and Wyoming from the elementary school efforts. One of these concentrated on attitudes at two levels, namely primary and intermediate. The others concentrated on science scores across the 1-6 grades on the Science Test of the Iowa Tests of Basic Skills.

Tables 2a.1 through 2a.27 are a tabulation of the pre and post attitude scores from primary age students for the elementary school groups. For purposes of tabulation the Wyoming groups are computed as a single group since both workshops that were conducted enrolled teachers from a variety of districts. For Florida the Broward and Hillsborough results are tabulated separately and as a total. The same information and same format is used for reports of intermediate aged students in Tables 2b.1 through 2b.24.

Although the leadership in the separate school districts found the assessment of student attitudes to be interesting and useful, the data tabulated in the 2a and 2b series is not particularly meaningful or useful in assessing Phase II workshop effectiveness or the effectiveness of the leadership training efforts. Apparently there is more meaning when one looks at the results with individual teachers and when it is related to the total school curriculum and the particular sequence of science in the particular exemplary program. The lack of overall significant results suggest that the decision to use exemplary materials and procedures does not affect student attitudes concerning the specific items included in the assessment instrument.

There was general interest in studying the effects of new curriculum implementation upon scores on standardized science exams. The Science Test of the Iowa Tests of Basic Skills was used. The pre and posttest scores for the Wyoming and two Florida groups are included in Tables 2c.1 through 2c.5. As in the case of attitude, the implementation of new (and presumably better materials and approaches) did not affect the science scores in any way.

The results with student attitude and knowledge acquisition are not encouraging. Of course, neither are they discouraging if the attitude and knowledge items are not appropriate in terms of the objectives of the teachers and/or the developers of the exemplary materials and approaches. The results of the changes were measured better by individual teachers and with instruments provided by the leadership in a particular district. Student growth was greater and attitudes were more positive in classrooms where teachers were more positive and enthused with the new materials and approaches.

Generalities

The efforts in Florida and Wyoming with respect to work with new teachers in helping them use science materials and approaches judged exemplary by NSTA was not as impressive as anticipated initially. However, the attempt permits the following generalities:

1) Other teachers can learn from teacher leaders and they can successfully implement new materials and strategies in their own classrooms;
2) Teacher leaders/curriculum developers can become important parts of leadership teams as attempts are directed to implementing exemplary programs in new classrooms;
3) When large numbers of new teachers use new science programs for the first time, student attitude is not found to become more positive;
4) When large numbers of new teachers implement new materials and approaches, student learning in science as measured by standard achievement examinations is not affected; at least it can be argued that new and presumably better programs used by less creative teachers do not worsen student attitudes nor result in less learning as measured by standard instruments during the first year of such implementation.

TABLE 2a.1

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING TO READ FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	81%	8%	8%	3%
	Post	74	8	18	0
Florida Broward	Pre	83	3	14	0
	Post	76	2	20	2
Florida Hillsborough	Pre	89	3	7	1
	Post	85	4	10	1
Florida Total	Pre	86	3	10	1
	Post	82	3	13	2
ALL TOTAL	Pre	85	4	10	1
	Post	80	4	14	1

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

TABLE 2a.2

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT WEATHER FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	53%	8%	39%	0%
	Post	45	9	45	0
Florida Broward	Pre	49	11	40	1
	Post	53	12	35	0
Florida Hillsborough	Pre	57	15	26	3
	Post	71	9	17	3
Florida Total	Pre	53	13	32	2
	Post	66	10	22	2
ALL TOTAL	Pre	53	12	34	2
	Post	61	9	28	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

TABLE 2a.3

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT NUMBERS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	66%	7%	26%	1%
	Post	61	15	24	0
Florida Broward	Pre	64	7	29	1
	Post	63	6	31	0
Florida Hillsborough	Pre	72	7	19	2
	Post	78	8	12	2
Florida Total	Pre	68	7	23	2
	Post	74	7	17	2
ALL TOTAL	Pre	68	7	24	2
	Post	71	9	19	1

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.4

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT (TEACHER'S WORD) FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	73%	9%	18%	0%
	Post	70	6	24	0
Florida Broward	Pre	70	4	24	0
	Post	61	10	27	2
Florida Hillsborough	Pre	82	7	9	2
	Post	76	12	10	2
Florida Total	Pre	77	6	16	1
	Post	72	11	14	2
ALL TOTAL	Pre	76	6	17	1
	Post	72	10	17	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.5

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT PLANTS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	61%	8%	31%	0%
	Post	70	6	24	0
Florida Broward	Pre	69	8	23	0
	Post	55	8	37	0
Florida Hillsborough	Pre	72	4	19	6
	Post	76	5	16	3
Florida Total	Pre	71	6	21	3
	Post	71	6	21	2
ALL TOTAL	Pre	68	6	23	2
	Post	70	6	22	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.6

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT ANIMALS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	78%	4%	18%	0%
	Post	88	2	9	1
Florida Broward	Pre	88	0	12	0
	Post	90	2	8	0
Florida Hillsborough	Pre	80	6	12	3
	Post	79	7	11	3
Florida Total	Pre	83	3	12	2
	Post	82	6	10	2
ALL TOTAL	Pre	82	3	13	2
	Post	83	5	10	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.7

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING READING A BOOK ON ELECTRICITY FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	55%	15%	30%	0%
	Post	47	17	36	0
Florida Broward	Pre	44	17	39	0
	Post	47	16	37	0
Florida Hillsborough	Pre	58	13	27	2
	Post	62	15	20	3
Florida Total	Pre	51	15	33	1
	Post	58	16	25	2
ALL TOTAL	Pre	52	15	32	1
	Post	55	16	28	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.8

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING DOING SOMETHING WITH MAGNETS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	76%	7%	18%	0%
	Post	79	5	17	0
Florida Broward	Pre	82	4	15	0
	Post	86	6	8	0
Florida Hillsborough	Pre	76	12	10	1
	Post	85	4	9	2
Florida Total	Pre	78	8	12	1
	Post	85	5	9	2
ALL TOTAL	Pre	78	8	14	1
	Post	83	5	11	1

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.9

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT THE SKY FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	65%	5%	28%	1%
	Post	64	9	26	2
Florida Broward	Pre	62	8	30	1
	Post	57	6	37	0
Florida Hillsborough	Pre	73	8	15	4
	Post	80	7	9	4
Florida Total	Pre	68	8	22	2
	Post	74	7	16	3
ALL TOTAL	Pre	67	7	23	2
	Post	72	8	19	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.10

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING READING ABOUT DINOSAURS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	68%	9%	23%	0%
	Post	64	11	26	0
Florida Broward	Pre	77	9	14	0
	Post	69	14	16	0
Florida Hillsborough	Pre	72	9	17	1
	Post	75	9	14	2
Florida Total	Pre	75	9	16	1
	Post	74	10	14	2
ALL TOTAL	Pre	73	9	17	1
	Post	71	10	17	1

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.11

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BEING A SCIENTIST FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	64%	16%	20%	0%
	Post	71	8	21	0
Florida Broward	Pre	67	8	24	0
	Post	67	8	24	0
Florida Hillsborough	Pre	63	12	24	1
	Post	74	7	17	3
Florida Total	Pre	65	10	25	1
	Post	72	7	19	2
ALL TOTAL	Pre	64	11	24	1
	Post	72	7	19	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.12

CHECK OF RELIABILITY ON

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT ANIMALS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	66%	14%	20%	0%
	Post	80	2	18	0
Florida Broward	Pre	83	6	11	0
	Post	78	6	16	0
Florida Hillsborough	Pre	82	7	10	0
	Post	76	5	15	4
Florida Total	Pre	83	7	10	0
	Post	76	5	16	3
ALL TOTAL	Pre	79	8	13	0
	Post	77	4	16	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.13

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING DOING SOMETHING WITH PLANTS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	68%	8%	23%	1%
	Post	67	11	23	0
Florida Broward	Pre	65	12	23	1
	Post	71	10	18	0
Florida Hillsborough	Pre	62	12	26	0
	Post	72	8	16	4
Florida Total	Pre	63	12	25	0
	Post	72	9	17	3
ALL TOTAL	Pre	64	11	24	1
	Post	70	9	18	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.14

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING READING ABOUT WITCHES FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	65%	19%	16%	0%
	Post	68	12	20	0
Florida Broward	Pre	65	12	22	1
	Post	51	24	24	0
Florida Hillsborough	Pre	72	12	13	2
	Post	62	17	17	4
Florida Total	Pre	69	12	17	2
	Post	59	19	19	3
ALL TOTAL	Pre	68	14	17	1
	Post	61	17	19	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.15

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BEING A POLICE OFFICER FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	73%	12%	15	0%
	Post	62	11	27	0
Florida Broward	Pre	62	12	25	1
	Post	71	4	24	0
Florida Hillsborough	Pre	66	18	15	2
	Post	76	9	11	4
Florida Total	Pre	64	15	19	2
	Post	56	8	14	3
ALL TOTAL	Pre	66	14	18	1
	Post	72	9	18	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.16

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING DOING SOMETHING WITH ROCKS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	65%	15%	20%	0%
	Post	53	18	29	0
Florida Broward	Pre	45	32	23	0
	Post	49	20	31	0
Florida Hillsborough	Pre	58	23	18	1
	Post	51	25	22	2
Florida Total	Pre	52	27	20	1
	Post	51	24	24	2
ALL TOTAL	Pre	55	24	20	1
	Post	51	22	25	1

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.17

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING DOING SOMETHING WITH (TEACHER'S WORD) FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	61%	14%	26%	0%
	Post	68	8	24	0
Florida Broward	Pre	66	13	21	0
	Post	73	4	18	4
Florida Hillsborough	Pre	62	19	17	2
	Post	70	14	12	4
Florida Total	Pre	64	16	19	1
	Post	71	11	13	4
ALL TOTAL	Pre	63	16	20	1
	Post	70	10	16	3

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.18

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BEING A TEACHER FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	66%	12%	20%	1%
	Post	64	17	20	0
Florida Broward	Pre	61	13	26	0
	Post	63	18	18	0
Florida Hillsborough	Pre	79	12	7	2
	Post	75	15	7	3
Florida Total	Pre	71	12	16	1
	Post	72	16	16	2
ALL TOTAL	Pre	70	12	17	1
	Post	70	16	17	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.19

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING GETTING A GIFT FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	93%	3%	5%	0%
	Post	97	2	2	0
Florida Broward	Pre	95	2	4	0
	Post	98	0	2	0
Florida Hillsborough	Pre	93	2	4	1
	Post	95	1	1	2
Florida Total	Pre	94	2	4	1
	Post	96	1	2	2
ALL TOTAL	Pre	93	2	4	1
	Post	96	1	2	1

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.20

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING READING A BOOK ON SPACE SHIPS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	66%	15%	18%	1%
	Post	64	20	17	0
Florida	Pre	68	16	16	1
Broward	Post	51	20	27	2
Florida	Pre	64	12	23	1
Hillsborough	Post	68	12	17	3
Florida Total	Pre	66	14	20	1
	Post	64	14	19	3
ALL TOTAL	Pre	66	14	19	1
	Post	64	16	19	2

WY	N = pre 74; post 66
FLB	N = pre 114; post 49
FLH	N = pre 137; post 138
FL total	N = pre 251; post 187
All Total	N = pre 325; post 253

TABLE 2a.21

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BEING A SHOE SALESPERSON FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	51%	14%	34%	2%
	Post	42	21	36	0
Florida Broward	Pre	33	36	30	1
	Post	24	45	31	0
Florida Hillsborough	Pre	54	20	25	1
	Post	53	25	17	4
Florida Total	Pre	45	27	27	1
	Post	45	30	21	3
ALL TOTAL	Pre	46	24	29	1
	Post	45	28	25	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.22

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT SCIENCE FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	61%	14%	26%	0%
	Post	79	6	15	0
Florida Broward	Pre	78	5	17	0
	Post	69	12	18	0
Florida Hillsborough	Pre	76	10	12	1
	Post	80	7	11	1
Florida Total	Pre	77	8	14	1
	Post	78	9	13	1
ALL TOTAL	Pre	73	9	17	1
	Post	78	8	13	1

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.23

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING TRYING TO FIND AN ANSWER FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	45%	27%	27%	1%
	Post	45	27	27	0
Florida Broward	Pre	52	21	27	0
	Post	42	29	29	2
Florida Hillsborough	Pre	51	20	27	1
	Post	51	25	23	1
Florida Total	Pre	51	21	27	1
	Post	48	26	25	2
ALL TOTAL	Pre	50	22	27	1
	Post	47	26	25	1

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.24

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BEING A DOCTOR FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	58%	16%	26%	0%
	Post	58	17	26	0
Florida	Pre	46	24	31	0
	Post	43	33	24	2
Florida Hillsborough	Pre	72	12	15	2
	Post	74	15	9	2
Florida Total	Pre	60	17	22	1
	Post	66	20	13	2
ALL TOTAL	Pre	59	17	23	1
	Post	64	19	16	1

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.25

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEARNING ABOUT OTHER PEOPLE FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	59%	11%	30%	0%
	Post	53	17	30	0
Florida Broward	Pre	56	12	30	2
	Post	61	16	22	0
Florida Hillsborough	Pre	66	14	18	2
	Post	64	12	20	4
Florida Total	Pre	61	13	24	2
	Post	64	13	20	3
ALL TOTAL	Pre	61	13	25	2
	Post	61	14	23	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.26

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING READING ABOUT AQUARIUMS FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	72%	12%	16%	0%
	Post	67	11	23	0
Florida Broward	Pre	75	7	17	1
	Post	69	10	20	0
Florida Hillsborough	Pre	74	11	13	1
	Post	79	9	8	4
Florida Total	Pre	75	9	15	1
	Post	76	10	11	3
ALL TOTAL	Pre	74	10	15	1
	Post	74	10	14	2

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2a.27

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING DRAWING A PICTURE FOR PRIMARY AGE STUDENTS

		Like	Dislike	Not Sure	No Response
Wyoming	Pre	80%	8%	11%	1%
	Post	77	8	15	0
Florida Broward	Pre	83	7	9	1
	Post	78	12	6	4
Florida Hillsborough	Pre	81	3	15	1
	Post	78	7	9	5
Florida Total	Pre	82	5	12	1
	Post	78	9	9	5
ALL TOTAL	Pre	82	6	12	1
	Post	78	8	10	4

WY N = pre 74; post 66

FLB N = pre 114; post 49

FLH N = pre 137; post 138

FL total N = pre 251; post 187

All Total N = pre 325; post 253

TABLE 2b.1

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING FAVORITE SUBJECT FOR INTERMEDIATE AGE STUDENTS

	Wyoming				Florida					
Florida		Florida		ALL						
			Broward		Hillsbrgh.		Total		TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Lang. Arts	17%	6%	17%	17%	17%	39%	17%	18%	17%	16%
Soc. Studies	3	8	6	10	8	25	8	8	7	8
Math	44	43	53	51	49	21	50	46	48	46
Science	36	43	23	23	26	15	25	28	28	31

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses.

TABLE 2b.2

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SECOND FAVORITE SUBJECT FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Lang. Arts	35%	35%	42%	35%	31%	32%	33%	33%	34%	33%
Soc. Studies	26	27	19	18	21	25	20	23	22	23
Math	17	14	26	28	28	26	28	27	25	24
Science	21	24	11	18	20	17	18	17	19	19

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.3

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LEAST FAVORITE SUBJECT FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Lang. Arts	44%	42%	44%	37%	36%	47%	38%	44%	39%	44%
Soc. Studies	21	16	21	26	22	16	21	19	21	19
Math	10	3	10	14	14	16	13	16	13	13
Science	25	38	22	23	28	21	26	21	26	24

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.4

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING MOST IMPORTANT PART OF SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Know World	34%	31%	52%	46%	45%	31%	47%	35%	44%	34%
Think Thru Problems	9	18	9	4	9	8	9	7	9	9
Being Courious & Exploring	57	51	40	50	46	61	44	58	47	57

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.5

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING FAVORITE KIND OF SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Life Science	36%	32%	46%	34%	35%	43%	37%	41%	37%	39%
Physical Science	21	35	26	40	30	26	29	30	27	30
Earth Scienc	43	34	28	26	35	31	34	30	36	30

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.6

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SCIENCE IS HARD FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	10%	3%	10%	9%	19%	10%	17%	10%	16%	9%
No	64	73	85	76	64	74	69	74	68	74
Uncertain	26	24	6	14	17	16	14	16	16	17

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.7

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING

WISH I HAD STUDIED MORE SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	56%	56%	62%	56%	56%	49%	57%	50%	57%	51%
No	29	23	28	35	28	37	28	37	28	34
Uncertain	16	20	10	10	16	14	15	13	15	14

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.8

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING FUN TO BE A SCIENTIST FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	55%	60%	67%	63%	55%	44%	58%	49%	57%	51%
No	26	15	18	22	23	31	22	28	23	26
Uncertain	19	24	15	15	22	25	20	22	20	23

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.9

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SCIENCE BOOKS ARE BORING FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	19%	15%	23%	14%	20%	27%	21%	23%	21%	22%
No	63	56	71	75	64	53	65	59	65	59
Uncertain	19	29	6	11	16	20	14	17	15	19

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.10

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SCIENCE SOLVES MANY WORLD PROBLEMS FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	80%	91%	90%	89%	81%	89%	83%	89%	82%	89%
No	6	2	5	6	6	2	6	3	6	3
Uncertain	14	7	6	5	12	9	11	8	11	8

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.11

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING VERY INTERESTED IN SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	59%	63%	69%	58%	62%	49%	64%	52%	63%	54%
No	16	10	17	23	22	28	21	27	20	24
Uncertain	24	27	14	19	16	22	16	21	17	22

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.12

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING LIKE TO DO SCIENCE PROJECTS FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	43%	52%	69%	64%	54%	26%	57%	37%	54%	39%
No	31	28	22	30	28	56	26	49	27	45
Uncertain	26	20	9	6	18	17	16	14	18	15

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.13

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING TEACHER KNOWS LOTS OF SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	61%	79%	71%	81%	72%	71%	72%	74%	69%	75%
No	1	2	10	4	6	5	7	5	6	4
Uncertain	39	19	19	15	22	24	21	21	25	21

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.14

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING DO NOT WANT TO TAKE HIGH SCHOOL SCIENCE FOR INTERMEDIATE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	24%	27%	40%	28%	33%	27%	34%	27%	33%	27%
No	32	38	44	50	44	47	44	48	43	46
Uncertain	44	36	16	21	23	26	22	25	24	27

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.15

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SCIENCE KNOWLEDGE WILL HLEP WHEN I'M GROWN UP FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	78%	88%	93%	87%	79%	72%	82%	76%	81%	78%
No	4	1	3	8	7	8	6	8	6	7
Uncertain	19	11	3	5	14	20	11	16	13	15

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.16

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING IMPORTANT TO PLAN EXPERIMENTS TO TEST IDEAS FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	68%	69%	83%	79%	75%	64%	77%	68%	75%	68%
No	10	5	9	11	8	18	9	16	9	14
Uncertain	22	26	8	10	17	19	15	16	16	18

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.17

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BORING TO BE A SCIENTIST FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	17%	5%	14%	12%	18%	20%	17%	17%	17%	15%
No	59	67	72	67	60	52	62	56	62	58
Uncertain	24	28	15	21	22	28	18	26	19	27

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.18

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SCIENCE KNOWLEDGE HELPS ME WHEN NOT AT SCHOOL FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	56%	77%	75%	71%	64%	66%	66%	68%	64%	69%
No	14	3	15	19	18	17	17	17	16	15
Uncertain	30	20	9	10	18	17	16	15	19	16

WY N = pre 140; post 98

FLB N = pre 124; post 127

FLH N = pre 417; post 337

FL total N = pre 541; post 464

All Total N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.19

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING SCIENCE IS EASY FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	60%	61%	67%	69%	67%	67%	67%	67%	65%	66%
No	12	9	21	16	14	16	16	16	15	15
Uncertain	28	29	12	15	18	17	17	16	19	18

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.20

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING

ALL CHILDREN SHOULD STUDY SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	49%	44%	53%	48%	50%	35%	50%	39%	50%	40%
No	30	32	33	42	33	46	33	45	32	42
Uncertain	21	24	14	10	17	19	16	16	17	18

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.21

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING BEING A SCIENTIST IS TOO MUCH WORK FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	19%	10%	24%	31%	22%	26%	22%	27%	22%	24%
No	49	56	60	50	52	42	54	44	53	46
Uncertain	33	34	15	20	26	33	24	29	26	30

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.22

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING PARENTS WANT ME TO LEARN SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	33%	41%	59%	54%	52%	37%	54%	41%	49%	40%
No	12	10	13	13	13	19	13	17	13	16
Uncertain	55	49	28	33	33	43	32	39	36	41

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.23

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING CAN MAKE THE WORLD BETTER IF I KNOW SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	37%	40%	60%	46%	36%	42%	41%	42%	40%	42%
No	24	19	23	25	31	22	29	22	28	22
Uncertain	39	41	17	28	32	36	29	33	31	34

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2b.24

PRE AND POST ASSESSMENT OF ATTITUDES CONCERNING TEACHER REALLY LIKES TEACHING SCIENCE FOR INTERMEDIATE AGE STUDENTS

	Wyoming		Florida Broward		Florida Hillsbrgh.		Florida Total		ALL TOTAL	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Yes	46%	66%	62%	61%	62%	62%	62%	61%	59%	61%
No	1	0	6	8	8	6	7	6	6	5
Uncertain	53	34	32	32	29	32	30	31	34	31

WY	N = pre 140; post 98
FLB	N = pre 124; post 127
FLH	N = pre 417; post 337
FL total	N = pre 541; post 464
All Total	N = pre 681; post 562

Percent may be greater than 100% because of rounding or missing responses

TABLE 2c.1

PRE AND POST SCORES FOR STUDENTS ENROLLED IN WYOMING FOR IOWA TEST OF BASIC SKILLS

Percentile rank converted to normal curve equivalent

	Normal curve equivalent	
	Pre	Post
Grade 1	71	73
2	57	59
3	62	66
4	66	64
5	59	62
6	66	64
Mean	64	65

Normal Curve Mean = 50

Standard deviation = 21.06

TABLE 2c.2

PRE AND POST SCORES FOR STUDENTS ENROLLED IN BROWARD COUNTY (FLORIDA) FOR IOWA TEST OF BASIC SKILLS

Percentile rank converted to
normal curve equivalent

Normal curve equivalent

	Pre	Post
Grade 1	67	68
2	58	58
3	67	66
4	52	46
5	52	58
6	*	*
Mean	59	57

*No teachers participated at this grade level

Normal Curve Mean = 50

Standard deviation = 21.06

TABLE 2c.3

PRE AND POST SCORES FOR STUDENTS ENROLLED IN HILLSBOROUGH (FLORIDA) FOR IOWA TEST OF BASIC SKILLS

Percentile rank converted to
normal curve equivalent

Normal curve equivalent

	Pre	Post
Grade 1	46	46
2	47	58
3	62	57
4	65	68
5	64	63
6	56	52
Mean	57	57

Normal Curve Mean = 50

Standard deviation = 21.06

TABLE 2c.4

SUMMARY OF PRE AND POSTTEST SCORES ON IOWA TEST OF BASIC SKILLS FOR ALL FLORIDA STUDENTS

Percentile rank converted to normal curve equivalent

Normal curve equivalent

	Pre	Post
Grade 1	58	46
2	55	58
3	63	60
4	62	64
5	61	62
6	56	52
Mean	59	57

Normal Curve Mean = 50

Standard deviation = 21.06

TABLE 2c.5

SUMMARY OF ALL PRE AND POST TEST SCORES FOR ALL STUDENTS ENROLLED DURING 1986-87 IN

IOWA TEST OF BASIC SKILLS
Percentile rank converted to
normal curve equivalent

Normal curve equivalent

	Pre	Post
TOTAL		
Grade 1	66	68
Grade 2	57	59
Grade 3	62	64
Grade 4	64	64
Grade 5	60	62
Grade 6	62	59
Mean	62	63

Normal Curve Mean = 50

Standard deviation = 21.06

Part III Student Assessment with STS Initiatives

As plans for Year III were finalized, it was decided that the STS initiatives in Utah and in Iowa warranted serious attention and assistance. Exemplary programs had been identified in both; teacher leaders were available; several had been involved with previous leadership efforts at past Honors Workshops. In Utah a state mandate had passed which called for STS emphasis across the junior high years. In Iowa the leadership had identified more practical science for grades 4 through 9 as a top need and a priority for attention. The summer leadership workshop was held again on the University of Iowa campus. It was directed entirely upon planning the implementation activities and the Phase II workshops in the two states. Major time was spent in assessment plans and schedules.

Although contact between the Utah and Iowa efforts has continued, a break-down in the in-school assessment efforts has occurred. This was caused primarily by the exit of state coordinator, Herbert Brunkhorst, who moved from a position at Weber State University to one at California State University-Long Beach. Much of the assessment data collected in Utah has been used in reports at the local level and to the State Department. There has been no attempt to collate statewide results. And, the individual reports sent to the central office in Iowa have been too incomplete to permit tabulation and comparison with Iowa samples. Hence the student assessment with respect to STS implementation is limited to the Iowa sample where the number of participants, schools, and assessment instruments has been greater than in the Utah situation. It remains an interesting possibility to maintain contact and collaboration with Utah colleagues beyond the time of Honors Workshop funding.

Tables 3.1 through 3.33 provide specific information concerning STS assessment in Iowa schools. Rationale and general assessment is described in two published reports included as Appendix VII. Several other reports included as Appendix VIII provide criteria and contexts for the data produced during the 1986-87 STS implementation efforts for new teachers and students in Iowa.

Tables 3.1 through 3.5 provide information concerning student perceptions of specific abilities and how their science (STS) has affected them. Generally the results are very positive and provide strong evidence of how STS approaches can affect student attitudes. Unfortunately there are no comparable data for each grade level 3 through 11 to permit grade by grade comparisons. However, most of the items were used for Science Assessment by the National Assessment of Educational Programs (NAEP) in 1977 and five years later in 1982. NAEP assesses nine, thirteen, and seventeen year old samples (3rd, 7th, and 11th grade students). If one looks at the Iowa 4th and 7-8th grade students only, the STS results in Iowa illustrate dramatically the effects of STS materials and approaches. The Iowa students are much more positive about their perceptions in each category reported in Tables 3.1 - 3.5.

Tables 3.6 through 3.14 offer comparisons between students enrolled in science experienced in an STS format where STS teaching strategies are employed versus a control group in each school. The information was collected from students enrolled in five schools where five of the Iowa leadership teachers were employed. The contrast between the two groups of student perceptions is great. In all cases the situation reported by STS students is more positive.

Tables 3.6 and 3.7 include perceptions of students who like science while Tables 3.8 includes information concerning student dislike of science. There are many more STS students who list science as their favorite or second favorite subject as compared to students from non-STS classes in the same school. In a similar manner no STS student selected science as their least favorite subject while 3% of the students in control classes so identify science.

Tables 3.9, 3.10, and 3.11 display further data which illustrate the advantages of STS approaches. Students who study science in an STS format are significantly more pleased with their science classes than students in non-STS courses. STS students report that their science classes assist them with decision making, prepare them for living in the future and in general to a significantly greater degree than do students in non-STS classes. STS students also report their science classes to be more fun, interesting, exciting, and less boring than do students in non-STS classes. STS students also report that their science classes make them feel more successful, curious, and prepared to make decisions than do students in non-STS classes.

Table 3.12 displays data that permit a comparison of STS students versus those enrolled in standard science classes regarding their views of their science teacher. As previously, the STS students are more positive than are students enrolled in standard science classes. STS students perceive their science teachers as liking them to ask frequent questions, really liking science, admitting frequently to not knowing, and making science exciting much more often than do students in typical science classrooms.

Table 3.13 provides information which compares STS students with students in a regular science class with respect to their knowledge of eight science concepts. STS students are more knowledgeable of the terms than are students enrolled in a standard course.

Table 3.14 provides contrasts between STS and students in a standard class concerning their views of what it would be like to be a scientist. The views of

STS students are more positive than those in a standard course. Their more positive views are concerned with science being fun, a means of becoming rich, too much work, lonely, boring, and making a person feel important.

Table 3.15 provides information produced by the 60 teachers enrolled in three of the Iowa STS workshops at the close of their experience with teaching STS in grades 4-9 in 31 Iowa schools. The differences are striking and provide direct evidence of a change in teaching behaviors when shifting to an STS format. In every case the teacher using STS approaches accomplished the following as in contrast to their behaviors when in a non-STS format:

1) Develop new materials and activities which introduce students to science-technology-society interactions;
2) Use existing materials and activities which introduce students to science-technology-society interactions;
3) Engender more positive feelings toward science learning among pupils in the classroom;
4) Create more positive feelings toward science teaching among administrators in the school;
5) Develop science teaching materials which are locally relevant;
6) Develop science instructional materials which are personally relevant to students;
7) Provide students with direct experience with materials;
8) Provide students with direct experience with making decisions;
9) Select appropriate instruments for in-school assessment of pupil progress in the five domains of science;
10) Realistically appraise the degree of science-technology-society related problem resolution we can hope for;

11) Illustrate science as an on-going process;

12) Relate science to pupils' career goals.

Tables 3.16 through 3.24 represent first attempts at standardizing student perceptions of items from the NAEP attitudinal items. As indicated previously numbers for only 3rd, 7th and 11th grades are provided since those were the grade levels included in the national assessments. Since the Iowa STS effort included teachers and students across more grade levels and at each grade level, questions arose as to what happens between grades 3 and 7 and between grades 7 and 11. The information is not always clear and consistent, i.e. the perceptions do not progress consistently across grade levels. This probably reflects differences in numbers across grade levels and, more importantly, the degree of success with STS for different teachers and in different schools. As might be expected, different teachers are more successful than others and different amounts of time are involved in different situations. As the situations become more stable, the attitude indicators also become more predictable. Teachers are excited about the results but are anxious for information about the possible, the expected, the learner dependence on the affective items assessed. The information recorded in Tables 3.16 through 3.24 indicates efforts to communicate, to serve, to evaluate continuing STS efforts in Iowa.

Tables 3.25 through 3.33 provide information that permits a comparison of results obtained for STS teachers and classrooms in Iowa with similar situations as reported by students in random classes (NAEP assessment results) and situations reported by students enrolled in NSTA exemplary science programs.

Tables 3.25, 3.26, and 3.27 illustrate impressively that students enrolled in Iowa STS programs compare very well with those enrolled in NSTA exemplary programs and superior to the situation found in random schools with respect to the popularity of science as a course in the total school program. Many more Iowa STS students select science as their favorite or second favorite course than do random students nationally; fewer STS students identify science as their least favorite course than the situation found in random schools.

Table 3.28 provides information which permits a comparison of student perceptions of the usefulness of science classes among students in random schools, those in NSTA exemplary programs, and those in Iowa STS classrooms. In general, the Iowa students compare very favorably. The differences in the three situations is much less than it is for other perceptions.

Table 3.29 offers a similar comparison concerning specific student descriptors for their science classes. STS students see their classes very favorably in terms of their being interesting, fun, exciting, and not boring. In general, the Iowa students fall between those found in random schools and those enrolled in NSTA exemplary programs.

Table 3.30 provides information that permits comparison of Iowa STS students and their perceptions of how their science classes make them feel. Again, the comparisons are very favorable with the Iowa STS students comparing very favorably with those enrolled in NSTA exemplary programs and more positive than those enrolled in randomly selected science classes.

Table 3.31 includes a summary of student perceptions about their science teachers. As in the case of science classes, Iowa STS students have very favorable attitudes of their science teachers. The Iowa students see their teachers liking them to question while frequently admitting that they do not know all the answers themselves. Their perception of their teachers admitting not to know seems to be one of the most important distinctions between least and most effective science teachers. It seems to result in more student involvement, excitement, and interest. A teacher who seems to know all is not often a motivator and a person who stimulates interest.

Table 3.32 includes interaction that permits comparison of knowledge of eight science concepts for Iowa STS students, students in NSTA exemplary programs, and students at random. Although there are some curious differences reported for Iowa students, there are no glaring ones that would suggest that Iowa STS students were at a disadvantage or that they were not learning about some basic concepts.

Table 3.33 presents information from the same three groups with respect to student perceptions of what it would be like to be a scientist. The perceptions of Iowa STS students are very positive with few surprises except for their perception that a career in science would be "too much work". The number of Iowa students with such a perception is much higher than for all other groups assessed.

Tables 3.34 through 3.38 contain information that permits the comparison of the perceptions of Iowa STS students compared with other groups as to their ability to act. Although there are several differences suggesting the importance of continued efforts, monitoring, and comparisons, the results for Iowa STS students compare favorably with the situation reported by students in NSTA exemplary programs.

Assessment has been a major focus and effort for the Iowa STS experiment. Five domains have been recognized as important, namely:

1) Knowing and Understanding (knowledge domain)
2) Exploring and Discovering (process of science domain)
3) Imagining and Creating (creativity domain)
4) Feeling and Valuing (attitudinal domain)

5) Using and Applying (applications and connections domain)

Assessment has been attempted in all five. Appendix IX is a collection of the instruments developed and tested during the 1986-87 academic year. They are in use again in more polished form for 1987-88.

Assessment in the knowledge domain was accomplished with existing textbook and/or teacher made tests. In general the results consistently revealed that there was no statistical difference in the amount of information acquired. Test scores were remarkably similar to the situation when the study of science concepts per se was the primary focus. That is to say that STS science results in the acquisition of nearly identical information by students even though such acquisition for its own sake is not an objective with the STS approach.

Process measures have indicated that STS students are better in demonstrating their ability with such skills. STS students are better problem solvers.

Creativity measures that have been developed and used as pilot instruments have also produced exciting results. Regular science courses seem to discourage creativity. Scores are frequently worse after studying science than initially. However, STS students are measurably improved in such areas as curiosity, quality of questions, number of questions, proposing possible explanations, preparing experimental procedures, recognizing the difference between cause and effect.

Several application tests have been constructed. In every case STS students exhibit the ability to use/apply information to a much higher degree than do students in regular science courses where the textbook is used frequently and testing focuses almost exclusively on information acquisition.

Generalities

The STS effort in Iowa has resulted in several measurable advantages when the situation is compared to the results obtained in standard science classes in random schools where NSTA exemplary programs have been identified. Some of these advantages include:

1) Iowa STS students have extremely positive perceptions of their ability to affect problems and to resolve issues;

2) Iowa STS students are more positive about the study of science than are students in standard courses;

3) Iowa STS students perceive their science classes as more useful than do students in control classes;

4) Iowa STS students report that their science classes are more fun, exciting, interesting, and less boring than do students in control classes;

5) Iowa STS students are more curious and feel more prepared to make decisions that do students in control classes;

6) Iowa STS students are more positive about their science teachers than are students in control classes;

7) Iowa STS students are more knowledgeable of selected science concepts than are students enrolled in control classes;

8) Iowa STS students have more accurate perceptions of what a career in science will be like than do students enrolled in control classes;

9) Iowa STS teachers report possessing at least a dozen STS teaching behaviors after workshop instruction and actual STS teaching than they possessed initially;

10) The NAEP affective items can be used to investigate the effect of STS

instruction across the grade 3-12 levels;

11) Students in Iowa STS classes have very similar and very positive attitudes concerning science classes, teachers, the usefulness of their science study when compared to students enrolled in NSTA exemplary programs;

12) Iowa STS students know as much concerning eight sample concepts of science as random students and those enrolled in NSTA exemplary programs;

13) Iowa STS students have some accurate perceptions of what science careers are like; their perceptions compare favorably with the student measures taken in random schools as well as NSTA exemplary centers;

14) Iowa STS students compare very favorably with other students from NSTA exemplary programs in terms of their perceptions of their ability to act on problems and to resolve issues;

15) Iowa STS students show evidence of developing more process skills than do students generally; and, they can apply these skills better in daily life situations;

16) Iowa STS students develop more creativity skills such as questioning, quality of questions, formation of possible explanations, proposals for experimentation, and identification of cause and effect relationships than do students in general;

17) Iowa STS students can demonstrate their ability to apply science concepts to everyday problems and the resolution of societal issues better than can students in general.

TABLE 3.1

PERCENTAGE OF STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO AFFECT SOCIAL PROBLEMS

Grade level of respondents:	3	4	5	6	7	8	9	10	11
I can do something about:									
Pollution	49	70	67	64	64	70	74	81	86
Energy waste	71	76	64	48	55	62	60	77	76
Food shortages	51	52	51	49	52	51	50	57	71
Over population	27	25	16	16	23	18	32	22	43
Diseases	51	36	29	25	30	29	30	46	43
Depletion of natural resources	63	55	40	36	35	40	43	53	43
Hazardous waste	20	41	38	28	21	34	27	32	33
Running out of clean water	59	55	45	44	36	51	41	44	52
Nuclear arms race	34	22	14	12	18	14	24	25	24
Number of students responding at each grade level:	41	229	401	420	182	253	74	68	21

Positive = definitely, sometimes, and yes responses

TABLE 3.2

PERCENTAGE OF STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR WILLINGNESS TO SOLVE WORLD PROBLEMS

Grade level of respondents:	3	4	5	6	7	8	9	10	11
I am willing to, even if inconvenient:									
Use less electricity	78	89	86	75	67	74	72	78	81
Use bikes or walk more often	90	89	92	86	73	78	69	71	71
Clean up litter	61	77	68	63	42	60	45	41	81
Separate trash	71	73	63	52	41	42	42	49	57
Ride in small economy car	61	63	59	62	57	66	72	74	76
Use less heat to save fuel	54	66	53	46	35	48	42	62	71
Use returnable bottles	85	91	87	83	82	86	77	82	95
Number of students responding at each grade level:	41	229	405	420	182	253	74	58	21

Positive = definitely, sometimes and yes responses

TABLE 3.3

PERCENTAGE OF STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO DO SCIENCE RELATED THINGS

Grade level of respondents:	3	4	5	6	7	8	9	10	11
How often do you:									
Try your ideas	46	58	50	44	40	52	40	53	62
Believe what you read about science	63	63	59	57	54	60	62	55	48
Check school work for accuracy	51	42	45	37	37	38	42	29	48
Read labels before buying	59	53	42	35	32	35	41	35	48
Look at all sides of a question before deciding	66	68	60	56	48	63	53	53	67
Believe events have logical explanations	51	49	54	52	53	64	62	65	72
Prefer being told an answer	12	35	29	35	40	37	38	49	33
Like to figure out how things work	61	62	57	57	46	53	55	56	71
Change your mind when ideas don't fit facts	49	51	56	50	47	52	49	49	24
Keep working on a task when ideas don't fit facts	39	44	32	27	19	23	30	19	24
Keep working when un-expected problems occur	46	48	43	37	37	48	38	52	43
Feel time wasted when idea doesn't work	39	31	33	28	36	31	41	32	48
Gather variety of information before trying	59	49	41	31	30	39	41	40	38
Number of students responding at each grade level:	41	229	401	420	182	253	74	68	21

Positive = always and often responses

TABLE 3.4

PERCENTAGE OF STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO DO TASKS REQUIRING USE OF SCIENCE SKILLS

Grade level of respondents:	3	4	5	6	7	8	9	10	11
I have tried to:									
Fix something electrical	24	46	41	52	58	64	62	75	57
Fix something mechanical	54	55	46	59	62	61	68	79	57
Help an unhealthy plant	51	48	34	33	25	30	32	29	38
Help an unhealthy animal	39	54	58	60	55	60	58	41	71
Number of students responding at each grade level:	41	229	405	420	182	253	74	68	21

Positive = many times and more than once responses

TABLE 3.5

PERCENTAGE OF STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO ACQUIRE VARIOUS HELPFUL APPLICATIONS FROM SCIENCE CLASSES

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Science classes have helped me:									
Drive a car	66	45	48	41	63	61	61	49	62
Cook	81	65	69	57	52	63	45	38	81
Repair a lamp	32	38	34	35	28	43	39	22	29
Decide who to vote for in the city council	46	35	29	25	19	27	24	21	38
Decide what exercises to do to stay healthy	76	69	75	61	68	64	37	57	76
Decide on snacks	73	75	72	60	64	64	35	56	76
Prepare a menu	63	56	50	39	41	47	24	28	57
Buy soap	32	39	29	30	35	35	27	25	52
Choose friends	66	53	58	33	46	44	34	28	38
Fix my bike	51	58	47	38	30	48	37	31	43
Number of students responding at each grade level:	41	229	401	420	182	253	74	68	21

Positive = definitely, sometimes and yes responses

TABLE 3.6

PERCENTAGE OF STUDENTS IDENTIFYING THEIR FAVORITE COURSES

	Experimental	Control
Language Arts	0	0
Social Studies	1	2
Mathematics	15	7
Science	14	4
Total number of respondents:	55	41

TABLE 3.7

PERCENTAGE OF STUDENTS IDENTIFYING THEIR SECOND FAVORITE COURSES

	Experimental	Control
Language Arts	0	2
Social Studies	0	3
Mathematics	14	9
Science	19	10
Total number of respondents:	55	41

TABLE 3.8

PERCENTAGE OF STUDENTS IDENTIFYING THEIR LEAST FAVORITE COURSES

	Experimental	Control
Language Arts	16	6
Social Studies	21	11
Mathematics	8	7
Science	0	3
Total number of respondents:	55	41

TABLE 3.9

PERCENTAGE OF STUDENTS WITH POSITIVE VIEWS CONCERNING THE USEFULNESS OF THEIR SCIENCE STUDIES

	Experimental	Control
Useful in:		
Daily Living	48	28
*Making Choices	34	13
**Future Living	40	28
**General	39	19
Total number of respondents:	51	41

* $p < .05$
**$p < .01$

TABLE 3.10

PERCENTAGE OF STUDENTS WHO RESPOND POSITIVELY ABOUT GIVEN DESCRIPTORS OF THEIR SCIENCE CLASSES

	Experimental	Control
Science Classes Are:		
*Fun	51	28
Interesting	48	28
*Exciting	38	17
*Boring	1	9
Total number of respondents:	55	41

* $p < .05$

TABLE 3.11

PERCENTAGE OF STUDENT RESPONSES TO DESCRIPTORS OF HOW SCIENCE CLASSES MAKE THEM FEEL

	Experimental	Control
Science Classes Make Me Feel:		
Uncomfortable	14	13
Successful	36	26
Curious	49	30
**Prepared to Make Decisions	40	26
Total number of respondents:	55	51

** $p < .01$

TABLE 3.12

PERCENTAGE OF STUDENTS WHO REPORT POSITIVELY SELECTED PERCEPTIONS OF THEIR SCIENCE TEACHERS

	Experimental	Control
Ask Frequent Questions	90	95
**Likes You to Ask Questions	48	28
Likes You to Give Your Ideas	48	32
Knows Much About Science	47	35
*Really Likes Science	49	22
Admits to Not Knowing	37	26
*Makes Science Exciting	49	31
Total number of respondents:	55	41

* $p < .05$
**$p < .01$

TABLE 3.13

PERCENTAGE OF STUDENTS ABLE TO SELECT MOST ACCURATE DEFINITIONS FOR EIGHT BASIC SCIENCE CONCEPTS

	Experimental	Control
Volume	12	10
Organism	8	3
**Motion	21	14
Energy	28	14
Molecule	10	2
Cell	21	7
Enzyme	2	0
Fossil	14	11
Total number of respondents:	55	41

**$p < .01$

TABLE 3.14

STUDENT PERCEPTIONS OF WHAT IT WOULD BE LIKE BEING A SCIENCTIST

	Experimental	Control
Be Fun	36	26
Make You Rich	11	24
Be Too Much Work	18	33
Be Boring	12	20
Make You Feel Important	21	29
Be Lonely	13	28
Total number of respondents:	55	41

TABLE 3.15

DIFFERENCES IN PERCEIVED ABILITIES OF TEACHERS BEFORE AND AFTER PARTICIPATING IN STS WORKSHOPS

	STORM LAKE		SPRINGBROOK		BETTENDORF	
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
Develop new materials and activities which introduce students to science-technology society interactions	6	94	30	89	11	77
Use existing materials and activities which introduce students to science-technology-society interactions	11	78	36	95	17	88
Engender more positive feelings toward science learning among pupils in my classroom	23	96	35	94	26	89
Create more positive feelings toward science teaching among my administrators at my school	22	68	33	78	32	73
Develop science teaching materials which are locally relevant	11	68	33	72	17	88
Develop science instructional materials which are personally relevant to students	33	86	33	94	20	88
Provide students with direct experience with materials	28	83	47	88	31	83
Provide students with direct experience with making decisions	23	77	24	76	14	68
Select appropriate instruments for in-school assessment of pupil progress in the five domains of science	23	45	18	41	9	31
Realistically appraise the degree of science-technology-society related problem resolution we can hope for	39	67	0	71	11	43
Illustrate science as an on-going process	34	78	18	76	43	89
Relate science to pupils' career goals	28	67	29	71	11	65

Note: Numbers expressed in percentage of those enrolled in each workshop to permit comparisons across groups.

n = 23 for Storm Lake, 24 for Springbrook, 48 for Bettendorf

TABLE 3.16

PERCENTAGE OF STUDENTS IDENTIFYING THEIR FAVORITE COURSES

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Language Arts	0	4	5	4	7	6	5	8	0
Social Studies	0	9	3	5	12	4	4	33	14
Mathematics	22	21	15	20	18	15	27	20	9
Science	13	17	14	16	11	17	14	15	9
Number of students responding at each grade level:	23	234	424	396	223	248	113	38	20

TABLE 3.17

PERCENTAGE OF STUDENTS IDENTIFYING THEIR SECOND FAVORITE COURSES

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Language Arts	9	5	5	6	9	10	7	5	0
Social Studies	4	8	10	10	13	9	4	5	0
Mathematics	9	15	17	14	19	17	18	18	18
Science	35	20	15	19	19	19	17	23	23
Number of students responding at each grade level:	23	231	423	395	222	247	113	36	22

TABLE 3.18

PERCENTAGE OF STUDENTS IDENTIFYING THEIR LEAST FAVORITE COURSES

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Language Arts	10	23	21	20	20	15	18	18	0
Social Studies	6	25	28	23	18	26	28	25	14
Mathematics	1	14	21	16	16	18	18	25	19
Science	0	5	9	16	11	9	12	18	38
Number of students responding at each grade level:	23	234	421	392	222	250	113	40	21

TABLE 3.19

PERCENTAGE OF STUDENTS WITH POSITIVE VIEWS CONCERNING USEFULNESSOF SCIENCE CLASSES

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Useful:									
In Daily Living	83	79	69	61	57	51	67	0	9
In Making Choices	65	53	46	25	31	28	32	18	9
In Future Living	96	81	69	61	61	60	62	0	9
Number of students responding at each grade level:	23	234	425	396	223	250	113	40	22

TABLE 3.20

PERCENTAGE OF STUDENTS WHO RESPOND POSITIVELY ABOUT GIVEN DESCRIPTIONS OF THEIR SCIENCE CLASSES

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Science Classes Are:									
Fun	91	80	64	61	64	56	70	88	9
Interesting	87	85	69	60	62	58	70	3	9
Exciting	74	75	56	45	47	49	51	0	9
Boring	9	13	20	22	27	32	20	0	0
Number of students responding at each grade level:	23	234	425	396	223	250	113	40	22

TABLE 3.21

PERCENTAGE OF STUDENTS' RESPONSES TO DESCRIPTORS OF HOW SCIENCE CLASSES MAKE THEM FEEL

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Science Classes Make Me Feel:									
Uncomfortable	9	15	11	18	10	11	17	3	0
Successful	83	67	45	37	28	38	27	0	0
Curious	65	73	65	54	53	60	66	0	5
Number of students responding at each grade level:	23	234	425	396	223	250	113	40	22

TABLE 3.22

PERCENTAGES OF STUDENTS FROM A VARIETY OF SETTINGS AND AGE LEVELS WHO REPORT POSITIVELY ABOUT SELECTED PERCEPTIONS OF THEIR SCIENCE TEACHERS

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Ask Frequent Questions	100	92	81	79	83	80	95	3	14
Likes You to Ask Questions	87	70	54	61	65	60	79	3	14
Likes You to Give Your Ideas	83	80	71	71	76	75	86	90	14
Knows Much About Science	52	74	57	64	61	64	81	93	5
Really Likes Science	48	68	47	57	56	63	70	3	5
Admits to Not Knowing	78	71	66	62	75	70	71	83	9
Makes Science Exciting	96	77	62	55	51	52	63	73	14
Number of students responding at each grade level:	23	234	424	396	223	250	113	40	22

TABLE 3.23

PERCENTAGE OF STUDENTS ABLE TO SELECT MOST ACCURATE DEFINITIONS FOR EIGHT BASIC SCIENCE CONCEPTS

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Volume	17	10	15	20	24	13	12	3	5
Organism	13	10	37	34	72	48	70	30	55
Motion	61	43	42	35	65	47	58	8	9
Energy	30	34	35	24	35	24	43	0	5
Molecule	26	25	25	35	44	59	61	25	32
Cell	22	32	39	44	66	51	61	3	9
Enzyme	0	4	9	3	11	13	16	*	*
Fossil	39	30	35	32	35	47	56	*	*
Number of students responding at each grade level:	23	234	425	396	223	250	112	40	22

*Fewer than half of the respondents did not answer the question.

TABLE 3.24

STUDENTS' PERCEPTIONS OF WHAT IT WOULD BE LIKE BEING A SCIENTIST

Grade level of respondents:	3	4	5	6	7	8	9	10	11
Be Fun	57	56	44	38	30	30	33	0	5
Make You Rich	17	34	33	26	32	32	31	0	5
Be Too Much Work	96	81	76	68	71	71	82	3	14
Be Boring	17	19	21	29	29	29	38	0	9
Make You Feel Important	61	58	49	43	42	42	50	0	5
Be Lonely	9	12	17	22	20	20	11	0	0
Number of students responding at each grade level:	23	234	425	396	223	250	113	40	22

TABLE 3.25

PERCENTAGE OF STUDENTS IDENTIFYING THEIR FAVORITE COURSES ACROSS GRADE LEVELS

	4th Grade			8th Grade		
	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Language Arts	24	4	4	15	5	6
Social Studies	3	2	9	13	5	4
Mathematics	48	24	21	30	16	15
Science	6	24	17	11	22	17

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.26

PERCENTAGE OF STUDENTS IDENTIFYING THEIR SECOND FAVORITE COURSES ACROSS GRAVE LEVELS

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Language Arts	24	9	5	18	11	10
Social Studies	4	0	8	14	5	9
Mathematics	20	14	14	19	18	17
Science	8	24	20	18	22	19

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Assocaition (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.27

PERCENTAGE OF STUDENTS IDENTIFYING THEIR LEAST FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Language Arts	22	19	23	28	22	15
Social Studies	3	0	25	12	38	26
Mathematics	18	19	14	27	22	18
Science	11	2	5	19	6	9

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.28

PERCENTAGE OF STUDENTS ENROLLED IN RANDOM SCHOOLS AND EXEMPLARY CENTERS WITH POSITIVE VIEWS CONCERNING THE USEFULNESS OF THEIR SCIENCE STUDIES

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Useful:						
In Daily Living	72	73	79	69	60	51
For Further Study	83	84	81	80	76	78
In Making Choices	51	64	53	48	76	48
In Future Living	90	90	81	76	68	60
In General	74	80	68	73	75	58

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.29

PERCENTAGE OF STUDENTS FROM VARIOUS SETTINGS AND FOR THREE AGE GROUPS CONCERNING THEIR SCIENCE CLASSES

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Science Classes Are Fun	64	92	80	40	83	56
Science Classes Are Interesting	84	82	85	51	85	58
Science Classes Are Exciting	51	78	75	43	72	49
Science Classes Are Boring	10	17	13	29	13	23

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n =234; for thirteen year olds n = 250)

TABLE 3.30

PERCENTAGE OF STUDENTS FROM VARIOUS SETTINGS AND FOR THREE AGE GROUPS CONCERNING DESCRIPTORS OF HOW SCIENCE CLASSES MAKE THEM FEEL

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Science Classes Make Me Feel:						
Uncomfortable	6	9	14	22	10	11
Successful	59	52	67	40	57	58
Curious	40	80	73	24	75	60
Prepared to Make Decisions	49	64	59	47	74	58

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.31

PERCENTAGE OF STUDENTS FROM A VARIETY OF SETTINGS AND AGE LEVELS WHO REPORT POSITIVELY ABOUT SELECTED PERCEPTIONS OF THEIR SCIENCE TEACHERS

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Asks Frequent Questions	88	92	92	75	91	80
Likes You to Ask Questions	58	80	70	55	87	60
Likes You to Give Your Ideas	66	70	80	44	84	75
Knows Much Science	69	58	74	61	88	64
Really Likes Science	35	31	68	78	86	63
Admits to Not Knowing	44	68	71	22	73	70
Makes Science Exciting	72	73	77	51	78	62

A - From students enrolled in classes of random sample of National Science Teachers Association members (n = 1075)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1060)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.32

PERCENTAGE OF STUDENTS ABLE TO SELECT MOST ACCURATE DEFINITIONS FOR EIGHT BASIC SCIENCE CONCEPTS

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Volume	29	12	10	75	65	13
Organism	66	43	10	67	71	48
Motion	41	14	43	65	62	47
Energy	40	29	34	54	45	24
Molecule	25	29	25	54	48	59
Cell	15	17	32	46	43	51
Enzyme	23	19	4	24	31	13
Fossil	36	29	30	54	48	47

A - From students enrolled in classes of random sample of National Science Teachers Association (n = 850)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 650)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.33

STUDENTS' PERCEPTIONS OF WHAT IT WOULD BE LIKE BEING A SCIENTIST

	Nine Year Olds			Thirteen Year Olds		
	A	B	C	A	B	C
Be Fun	20	60	56	44	65	60
Make You Rich	24	16	34	38	29	32
Be Too Much Work	25	11	81	26	14	71
Be Boring	43	9	19	29	11	29
Make You Feel Important	32	26	38	55	43	42
Be Lonely	24	11	12	22	12	20

A - From students enrolled in classes of random sample of National Science Teachers Association (n = 890)

B - From students enrolled in exemplary programs selected by National Science Teachers Association (n = 1140)

C - From students of Iowa teachers who attended 1986-87 Science/Technology/Society workshops (for nine year olds n = 234; for thirteen year olds n = 250)

TABLE 3.34

PERCENTAGE OF MIDDLE/JUNIOR HIGH STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO AFFECT SOCIAL PROBLEMS

I can do something about:	A	B	C
Pollution	67	78	70
Energy waste	60	61	62
Food shortages	47	54	51
Overpopulation	23	20	18
Diseases	31	38	29
Depletion of natural resources	36	44	40

A: National sample information from Third Assessment of Science by the National Assessment of Educational Progress, 1978, (N=2500).

B: Middle/Junior High Exemplary Program Students, 1987, (N=280).

C: Iowa sample information from teachers that participated in 1986-1987 Science/Technology/Society Workshops, (N=253).

Positive = definitely, sometimes, and yes responses

TABLE 3.35

PERCENTAGE OF MIDDLE/JUNIOR HIGH STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR WILLINGNESS TO SOLVE WORLD PROBLEMS

I am willing to, even if inconvenient:	A	B	C
Use less electricity	87	79	74
Use bikes or walk more often	87	82	78
Clean up litter	69	50	60
Separate trash	65	49	42
Ride in small economy car	78	69	66
Use less heat to save fuel	56	49	48
Use returnable bottles	88	85	86

A: National sample information from Third Assessment of Science by the National Assessment of Educational Progress, 1978, (N=2500).

B: Middle/Junior High Exemplary Program Students, 1987, (N=280)

C: Iowa sample information from teachers that participated in 1986-1987 Science/Technology/Society Workshops, (N=253).

Positive = definitely, sometimes, and yes responses

TABLE 3.36

PERCENTAGE OF MIDDLE/JUNIOR HIGH STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO DO SCIENCE RELATED THINGS

How often do you:	A	B	C
Try your ideas	40	46	52
Believe what you read about science	64	64	60
Check school work for accuracy	50	48	38
Read labels before buying	62	38	35
Look at all sides of a question before deciding	78	65	63
Believe events have logical explanations	60	66	64
Prefer being told an answer	69	35	37
Like to figure out how things work	69	56	53
Change your mind when ideas don't fit facts	45	57	52
Keep working when unexpected problems occur	52	52	48
Feel time wasted when idea doesn't work	58	30	31
Gather variety of information before deciding	46	42	39

A: National sample information from Third Assessment of Science by the National Assessment of Educational Progress, 1978, (N=2500).

B: Middle/Junior High Exemplary Program Students, 1987, (N=280)

C: Iowa sample information from teachers that participated in 1986-1987 Science/Technology/Society Workshops, (N=253).

Positive = always and often responses

TABLE 3.37

PERCENTAGE OF MIDDLE/JUNIOR HIGH STUDENTS WHO REPORT POSITIVELY CONCERNING THEIR ABILITIES TO DO TASKS REQUIRING SCIENCE SKILLS

I have tried to:	A	B	C
Fix something electrical	52	55	64
Fix something mechanical	58	60	61
Help an unhealthy plant	56	33	30
Help an unhealthy animal	47	55	60

A: National sample information from Third Assessment of Science by the National Assessment of Educational Progress, 1978, (N=2500).

B: Middle/Junior High Exemplary Program Students, 1987, (N=280)

C: Iowa sample information from teachers that participated in 1986-1987 Science/Technology/Society Workshops, (N=253).

*Positive = Many times or more than once

TABLE 3.38

PERCENTAGE OF STUDENTS WITH POSITIVE PERCEPTIONS OF THEIR ABILITY TO APPLY SCIENCE CLASS LEARNING TO DAILY DECISIONS

I have learned things that help me:	A	B	C
Drive a car	42	53	61
Cook	60	59	63
Repair a lamp	*	*	43
Decide who to vote for in the city council	*	*	27
Decide what exercises to do to stay healthy	*	*	64
Decide on snacks	50	56	64
Prepare a menu	*	*	47
Buy soap	*	*	35
Choose friends	*	*	44
Fix my bike	*	*	49

A: National sample information from Third Assessment of Science by the National Assessment of Educational Progress, 1978, (N=2500).

B: Middle/Junior High Exemplary Program Students, 1987, (N=280)

C: Iowa sample information from teachers that participated in 1986-1987 Science/Technology/Society Workshops, (N=253).

Positive = definitely, sometimes, and yes responses

*Data unavailable

Part IV Information from Video Tapes of Teachers Prior to and Following Workshop Experience

A new dimension for assessing workshop impact was added to Year III of the project. This dimension was the collection of pre-workshop and post-workshop video tapes of sample science lessons. Although 102 teachers volunteered to help, only 93 provided tapes for analysis. Twenty-five were selected for careful analysis. This form of assessment provides observational evidence of a change in teacher behavior as a result of workshop instruction/activities. Since video taping is more common in the STS classroom, the vast majority of tapes were provided by teachers involved with the STS workshops. Also, our greater contact with lead teachers and the follow-up workshops in Iowa resulted in a disproportionate number of sessions filmed in Iowa schools.

Some of the information gathered came from a questionnaire that was given to each teacher volunteer for this part of the assessment. The information was thought an important way of providing a context for the lesson that was taped as well as the philosophy and style of the particular teacher. Tables 4.1 through 4.9 provide the results of the questionnaire data and analysis of the pre and post workshop video tapes.

Table 4.1 provides information concerning primary sources for material used in planning and executing exciting pre and post video lessons. It is apparent that the workshops seemed to lower teacher dependence on the textbook for a source of ideas, increased the teacher ability and desire to plan his/her own lessons, increased the power of student ideas in developing model lessons, increased the use of current events as a source of lesson ideas, and did not seem to influence the use of other teacher references and notes as a source of ideas.

Table 4.2 provides similar information concerning the sources of information for teachers as they plan laboratory activities, especially those used as models (for the video taping project). It is again apparent that the STS workshop seems to influence the teacher in terms of sources of ideas for planning model laboratory activities. Textbooks and laboratory become less useful while student ideas, student questions, and current events become more important. There is also much evidence that the workshops stimulated much more attention to local issues and problems and therefore provided more of the setting for activities.

Table 4.3 provides information concerning the use of field trips as a part of model lessons. As might be expected STS teachers utilize human and material resources from the community at large to a high degree. Evidence is provided that the workshops affected teacher thinking and action regarding the use of such local resources. The natural environment in the area as well as local industries were both used to a greater degree after the teachers were enrolled in workshops and moved to STS approaches and topics.

Table 4.4 provides information concerning teacher use of a variety of classroom aids. The workshop series does not seem to have affected the use of standard kinds of aids. However, after workshop participation teachers used newspapers and periodicals, library resources, and community experts much more frequently than they did prior to participation.

Table 4.5 is a tabulation of teacher behavior observed on the video tapes prior to workshop participation and the number observed on a second tape following participation. It is apparent that major differences are observable between the tape that was prepared prior to the workshop and the one prepared afterwards. The STS format and teaching strategies demand observable behavior shifts apparent on the tapes. Teachers ask higher level questions. They provide fewer answers. They redirect questions and continue with probing behaviors; they frequently admit to not knowing themselves. They involve students to a far greater degree in elaboration, clarification, and/or apparent controversies and interpretations. In a sense, however, this is what STS teaching is about.

Table 4.6 provides information about sources of information used, suggested, or accepted by teachers in a model lesson prior to and following workshop instruction and introduction to STS strategies. Teachers refer to textbooks less and so do students. Teachers and students utilize current events to a greater degree in the STS format following workshop participation. Extended discussion of a current event as a student idea is far more common in classrooms following the STS teacher workshops.

Table 4.7 provides information concerning teacher reference to interdisciplinary studies as opposed to science activities in a specific discipline. After the STS workshop sessions teachers were much more inclined to think, act, and speak concerning broader issues, questions, considerations, and sources for input information. Also, ties to technology (science applications) were observable shifts as teachers moved to STS emphases.

Table 4.8 is a report of differences in student work mode. It is apparent that there are fewer whole class discussions, more small groups involved in a variety of tasks, and individuals involved with a variety of tasks in lessons taped following workshop participation.

Table 4.9 is a tabulation of the actual instructional materials in use by students in model classes planned and executed by teachers prior to and following STS workshops. Again, it is apparent that teachers felt that more student manipulations were desirable; more newspapers and periodicals were used.

It should be kept in mind that a major point of the STS workshops was to illustrate new approaches to science knowledge and process. It means beginning where students are and involving them in issues and problems that are current, local, and personally meaningful and important. The change in teacher strategies and functioning is emphasized. Perhaps the dramatic differences in the tapes are to be expected and may not reflect permanent changes and/or changes in use for significant periods of time. It is known, for example, that some teachers are more successful than others with STS teaching and some spend longer periods of time (whole courses) with such materials and approaches. The video tapes provided were from volunteers who received instruction and benefited from experienced models of STS teaching.

Generalities

The pre-and-post video tapes provide evidence of change of teacher behavior and practice. However, the tapes were provided by volunteers all of whom had spent workshop time with reviewing, observing, and analyzing desirable strategies for STS instruction. Nonetheless, it is possible to observe the following differences in what outstanding teachers consider to be exemplary teaching practices. These include:

1) Teachers are less dependent upon textbooks and verification-type laboratories;
2) Teachers depend more on local conditions and current events for teaching ideas and activities;
3) Teachers use students to a far greater degree as sources for questions, information, ideas, and ties to the community;
4) Instruction in STS encourages teachers to use the local environment

and local industries and out-of-school facilities to a greater degree;

5) STS teachers utilize traditional instructional aids while using newspapers, and other periodicals, the library, and local experts to a far greater degree;
6) STS teachers, after participation in special workshops, ask higher level questions, provide fewer answers, redirect questions, ask for more elaboration and clarification, and talk much less than they do prior to such workshops;
7) STS teachers push for less closure, look for more sources of ideas, relate their teaching to the local situation and current events to a greater degree after they participated in STS workshops and practiced STS approaches;
8) STS teachers refer more to multiple disciplines for information and request more interpretation than they did when teaching standard science courses prior to participation in a workshop;
9) STS teachers involve more students in individual and small group activities that vary from group to group and individual to individual after an STS workshop experience than before they participated;
10) Students in STS classes taught by teachers who have participated in STS workshops use a greater variety of materials than do students taught by the same teachers in a non-STS format prior to workshop experience.

TABLE 4.1

PRIMARY SOURCES OF TEACHER MATERIAL FOR USE IN PREPARING TEACHING UNITS AND MODEL LESSONS

	Pre	Post
Textbook	44	2*
Teacher designed curriculum	27	46*
Student ideas	6	16*
Current events	6	21*
Supplementary notes	10	8

n = 93 teachers who agreed to provide video tapes

*p < .05

TABLE 4.2

SOURCES OF INFORMATION FOR TEACHER USE IN DEVELOPING MODEL LABORATORY ACTIVITIES

	Pre	Post
Textbook	25	5*
Lab book	28	3*
Student designs	4	21*
Student question/idea	1	19*
Current event	3	15*
Other teachers	10	8
Developed personally	22	20

n = 93 teachers who agreed to provide video tapes

*$p < .05$

TABLE 4.3

TYPES OF FIELD TRIPS INCLUDED IN INSTRUCTIONAL UNITS BY STS TEACHERS

	Pre	Post
Nature area	12	21*
Museum/Planetarium	3	8
Factory/Power Plant/ Commerical Area	5	20*
Other parts of the school	3	10
Miscellaneous	4	5
None	46	19

n = 74 teachers who provided segments of STS lessons

*$p < .05$

TABLE 4.4

PERCENTAGE OF TEACHERS REPORTING USE OF SPECIFIC RESOURCES AND AIDS FOR THEIR SCIENCE TEACHING

	Pre	Post
Blackboard	98	97
Overhead projector	65	71
Slides	10	12
Films	55	40
Models	8	7
Newspapers/periodicals	10	25*
Library	12	30*
Community experts	4	29*

n = 93 teachers

*$p < .05$

TABLE 4.5

AVERAGE NUMBER OF OBSERVABLE TEACHER BEHAVIORS NOTED PRIOR TO WORKSHOP AND THOSE FOLLOWING WORKSHOP FOR A SINGLE CLASS PERIOD

	Pre	Post
Lectures (teacher talks for 5 minutes or more	3	0
Makes statements	21	11
o Asks an input question	33	43
o Asks a processing question	5	20*
o Asks an output question	0	21*
Answers questions by providing factual information	13	0*
Redirects students questions to others	1	15*
Expresses lack of knowledge	0	14*
Asks students to elaborate or clarify	0	23*
Uses, clarifies, or elaborates a student's comment or question	2	15*

o Input level = counting, matching, naming, defining, observing, reciting, identifying, recalling.

o Processing level = synthesizing, analyzing, categorizing, explaining, comparing, summarizing, inferring, sequencing, stating causality.

o Output level = applying, imagining, evaluating, predicting, creating, speculating, planning, generalizing.

* Tabulation based upon analysis of pre-post tapes for 25 volunteer teachers

* $p < .05$

TABLE 4.6

SOURCES FOR KNOWLEDGE CONSIDERED IN A SINGLE LESSON PREPARED BY TEACHERS PRIOR TO AND FOLLOWING WORKSHOP PARTICIPATION

	Pre	Post
Teacher reference to textbook	10	1*
Student reference to textbook	8	0*
Teacher reads from textbook	0	0
Student reads from textbook	1	0
Teacher reference to current event	4	21*
Student reference to current event	0	11*
Student reading from magazine, newspaper, journal	0	2
Teacher reading from magazine, newspaper, journal	0	0
Extended discussion of current event	0	12*
Extended discussion of student idea	0	13*

Tabulation based upon analysis of pre-post tapes for 25 volunteer teachers

* $p < .05$

TABLE 4.7

TEACHER REFERENCES TO INTERDISCIPLINARY STUDIES PRIOR TO AND FOLLOWING WORKSHOP PARTICIPATION

	Pre	Post
Societal applications of science	2	25
Technological application of science	4	21
Ideas from other subject areas		
Social Studies	0	10
Language Arts	1	11
Geography	0	2
Mathematics	6	7
Industrial Arts	0	4

Tabulation based upon analysis of pre-post tapes for 25 volunteer teachers

TABLE 4.8

STUDENT WORK MODE FOR CLASS PRIOR TO AND FOLLOWING WORKSHOP

	Pre	Post
Whole Class in discussion or lab	18	3
Small groups performing same task	6	2
Small groups performing different tasks	0	10
Individuals doing same task	1	0
Individuals doing different task	0	10

n = 25

Tabulation based upon analysis of pre-post tapes for 25 tapes selected from 93 volunteer teachers

TABLE 4.9

MATERIALS USED BY STUDENTS IN SCIENCE LESSONS PRIOR TO AND FOLLOWING WORKSHOP PARTICIPATION

	Pre	Post
None	2	0
Manipulable science materials	5	16*
Books	10	8
Workbooks	3	0
Newspapers/Journals/Magazines	0	12*
Own paper, notebooks	10	12
Movies or film strips	5	3

n = 25

Tabulation based upon analysis of pre-post tapes for 25 volunteer teachers

* $p < .05$

Part V Project Summary

The Iowa Honors Workshop was conceived as a leadership development program for teachers who had already been identified as exemplary or having developed exemplary programs. The 2,000 teachers who were the architects of the NSTA Search for Excellent Programs were sought out as prime participants. Presidential Award recipients and teachers active in state and national organizations were also encouraged to apply. One goal was to equip each participant with skills and materials for making workshop presentations concerning their exemplary materials and teaching practices. Other goals included the sharing of curriculum ideas and the development of "hybridized" versions of such materials. The teacher participants were also encouraged and helped to develop articles for publication concerning their programs and their teaching. Much time was spent with assessment and the actual collection of information that provided real evidence of program effectiveness. One special aspect of the program was to work with leaders in national organizations in science education in terms of using the talented teachers enrolled as presenters at conventions, in leadership roles in the organizations, and as authors in their publications. Many alliances in states were established and a permanent Think Tank for science education is being formed.

The following numbers were involved as participants in the program:

1984-85	Leaders	36
	Elementary Teachers	16
	Middle/Junior High Teachers	22
	Teachers of the Gifted in Science	39
	Applications of Science	29
	Science/Technology/Society	31
	Total:	173

1985-86	Wyoming Center:	Elementary Teachers	33
	Arizona Center:	Middle/Junior High Teachers	32
	Pennsylvania Center:	Teachers of the Gifted in Science	30
	Florida Center:	Applications of Science	29
	Iowa Center:	Science/Technology/Society	31
	Total:		155
1986-87	Summer -		
	Wyoming Center:	Elementary Science	8
	Florida Center:	Elementary Science	19
	Utah Center:	Science/Technology/Society	12
	Iowa Center:	Science/Technology/Society	23
	Total:		62
	TOTAL FOR ALL THREE SUMMERS		390
1986-87	Academic Year -		
	Wyoming Center:		53
	Florida Center:		273
	Utah Center:		38
	Iowa Center:		107
	TOTAL IN FOUR STATES		471
	GRAND TOTAL 3 SUMMER LEADERSHIP WORKSHOPS PLUS 1986-87 ACADEMIC YEAR PHASE II WORKSHOPS		861

The following products have been produced and records submitted for inclusion in the resource center at The University of Iowa:

Workshop Plans - 456
Workshop Presentations - 539
Manuscripts Prepared by Teachers - 286
Manuscripts Published by Teachers - 123
Curriculum Development Projects - 504

Many more were produced--but copies not submitted to the Workshop Central Office (See Table 1.7).

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Assessing the Impact of the Iowa Honors Workshop on Science Teachers and Students

APPENDICES

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ASSESSING THE IMPACT OF THE IOWA HONORS WORKSHOP ON SCIENCE TEACHERS AND STUDENTS

APPENDICES

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Final report for National Science Foundation Grant TEI-8317395

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Foreword

The Iowa Honors Workshop has been a most gratifying experience for the staff and from all accounts the 861 participating science teachers and leaders in science education. Many continuing friendships and much professional dialogue remains as testimony to the success of the effort. An entire report could be prepared based upon the impressions, statements of value, and examples of what happened in the lives of the participants and staff following the workshops. However, this report is meant to be a focus upon more quantifiable outcomes. The assessment of students enrolled in classrooms of the Phase II teachers (teachers who sought to learn about the programs and teaching strategies of the Honors group selected for the summer series) who were enrolled in workshops taught by teachers of exemplary programs. The report focuses upon the efforts to improve science in elementary schools and the move to science/technology/society programs in upper elementary and junior high schools. These efforts represented major departures from the original proposal but were directions that both the NSF staff and the Iowa staff were excited to take.

In one sense this report focuses upon the project as a whole with looks at what was proposed, what happened during the three summers, the materials and programs produced, and the results that occur when new teachers and their students become involved with exemplary science materials and teachers judged to be exemplary. This report does not attempt to summarize nor duplicate the interim reports that were submitted to NSF following the summer activities in 1984, 1985, and 1986.

The effort over a four year period has been a major one. It has affected many students, teachers, and schools. It has involved an ever growing staff as communications and involvement with the scientific and industrial communities have increased.

Although there have been significant changes in NSF staff, philosophy, and direction during the 1984-88 period, this project (Grant #TEI-831-7395) has resulted in many tangible products and many measured improvements. The readers must judge the ultimate significance and impact. Hopefully, this report will provide much direct evidence indicating the success of the program and proper use of NSF funds.

Robert E. Yager
Project Director

Acknowledgments

A project involving such a large staff and so many participants operates efficiently and effectively only when unique circumstances and peoples will it so. The Iowa Honors Workshop was fortunate to have an excellent staff both on the campus and at the satellite centers. The work in Pennsylvania, Florida, Arizona, Wyoming, and Utah was successful because of the coordinators who agreed to head these efforts. The many diverse project officers at NSF provided valuable input and suggestions; in fact, some of them influenced new direction and the assessment efforts in significant ways.

Special thanks are extended to Ronald Bonstetter whose efforts and leadership got the program rolling. After his departure, Joan Tephly became the full time coordinator for the last three years. Her conscientious efforts are in a large way responsible for the final products. The several secretaries associated with the project were essential ingredients in keeping the records, the communication, and the accounting on task. Special thanks is extended to Carolyn Lewis who was involved intimately with the process until all the testing was completed at the end of July, 1986. Dora Thompson stepped in at the end of the funding period to organize and prepare this final support.

To NSF staff, the workshop staff, and all 861 participants, I say thank you for jobs well done. Your involvement made the task of directing the four year effort an enjoyable and rewarding experience.

Robert E. Yager
Project Director

APPENDIX I

PARTICIPANT ROSTERS FOR SUMMER HONORS WORKSHOPS

1984 SCIENCE/TECHNOLOGY/SOCIETY HONORS WORKSHOP ROSTER
THE UNIVERSITY OF IOWA
June 10 - June 23, 1984

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Gary W. Appel Director	208 Lincoln, #3 Santa Cruz, CA 95060 (408_ 425-8408	Life Lab Science Programs 809 Bay Avenue Capitola, CA 95010 (408) 476-7140 ext 223
Gayle M. Ater Chem/Physics Teacher	8026 Jefferson (Former) Highway Apt #356 Baton Rouge, LA 70809 (504) 928-5328	LSU Laboratory School Louisiana State University Baton Rouge, IA 70803 (504) 338-3221
James E. Boles	RR, Box 9458 Spirit Lake, IA 51360	Spirit Lake High School Spirit Lake, IA 51360
Richard F. Brinkerhoff Physics/Chem/Astronomy Retired	RR 3, Box 33 Exeter, NH 03833 (603) 772-3596	Phillips Exeter Academy Exeter, NH 03833 (603) 772-4311
Wayne C. Browning Science Teacher	15 Overlook Road New City, NY 10956 (914) 634-4941	Clarkstown Sr. High School Crestwood Road New City, NY 10956 (914) 634-1831
Larry G. Clark Physical Science Teacher	1611 Ammon Road Toledo, OR 97391 (503) 336-3781	Toledo High School Ollalla Road Toledo, OR 97391 (503) 336-5104
Anna C. Codner Physical Science/9th	4311 Sunset Lane Columbus, NE 68601 (402) 563-2920	Columbus Junior High School 161 25th Avenue Columbus, NE 68601 (402) 564-7284
Michael J. Demchik Teacher	Box 265 Madison, WV 25130 (304) 369-4548	Boone County Schools Madison, WV 25130 (304) 837-3694
V. Carol Demchik Teacher	Box 265 Madison, WV 25130 (304) 369-4548	Boone County Schools Madison, WV 25130 (304) 837-3694
Sondra Dexter Teacher	2451 Legacy Drive SRA Box 1856 Anchorage, AK 99516 (907) 345-0182	Wendler Junior High School 2905 Lake Otis Parkway Anchorage, AK 99516 (907) 277-3591

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Dale Dye Biology Teacher	1027 East Court Street Iowa City, IA 52240 (319) 351-3006	West High School 2901 Melrose Avenue Iowa City, IA 52240 (319) 351-4550
Therese Ehrhart Science Teacher	1015 West Benton #57 Iowa City, IA 52240 (319) 338-8904	West High School 2901 Melrose Avenue Iowa City, IA 52240 (319) 351-4550
Julie A. Evans Biology/Chem. Teacher	RR 3, Box 217A Tipton, IA 52772 (319) 886-3452	West Branch High School Box 637 West Branch, IA 52358 (319) 643-5323
Charles E. Hafey Physic/Astronomy/ Chemistry Teacher	280 East Broad Street Columbus, OH 43215 (614) 459-8122	COSA Outreach Program 280 East Broad Street Columbus, OH 43215 (614) 228-6362
Jon Harkness Science Coordinator	1628 Becher Drive Wausau, WI 54401 (715) 675-6424	1200 West Wausau Avenue Wausau, WI 54401 (715) 675-3351
Curt Johnson Science Teacher	14585 Hickox Street Burton, OH 44021 (216) 834-4424	University Schools Shaker Heights, OH 44122 (216) 932-0400
David Kanellis Teacher	1115 Wylde Green Road Iowa City, IA 52240 (319) 338-3128	West High School 2901 Melrose Avenue Iowa City, IA 52240 (319) 351-4550
Eva Kirkpatrick Teacher	3511 Stonebrook Forest Imperial, MO 63052 (314) 942-3034	Seckman Junior High-Fox C6 2811 Seckman Road Imperial, MO 63052 (314) 296-5707
Arthur E. Lebofsky Science Dept. Chairman	7 Horsehoe Court New City, NY 10956 (914) 634-3588	Clarkstown South H.S. Demarest Mill Road East New City, NY 10956 (914) 623-9170
Teri E. Marchese Bilingual Classroom	240 Snyder Avenue Aromas, CA 95004 (408) 726-3108	Hall Elementary School 300 Sill Road Aromas, CA 95004 (408) 728-6371

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Loren B. Miller Biology Teacher	610 Lynn Street Tipton, IA 52772 (319) 886-2956	Tipton Community School 400 East 6th Tipton, IA 52722 (319) 886-2956
Waltina Mroczek Teacher	18127 Scottsdale Blvd. Shaker Heights, OH 44122 (216) 751-2786	Hilltop Elementary School Beechwood, OH 44122 (216) 464-2600
Cliff J. Prentice Physics Teacher	Box 98 Steamboat Rock, IA 50672 (515) 868-2284	Steamboat Rock Sch. Dist. Steamboat Rock, IA 50672 (515) 868-2226
Muriel B. Quinton Science Tcher/Dept Head	2134 Cartwright Road Missouri City, TX 77459 (713) 499-1266	Missouri City Jr. High Missouri City, TX 77489 (713) 499-9537
Kathleen P. Ranwez Science/Health Teacher	8408 West 77th Way Arvada, CO 80005 (303) 424-0865	Moore Junior High School 84 West 88th Avenue Arvada, CO 80005 (303) 420-8641
Greg K. Smith Biology/Physics/ Chemistry Tchr/Dept Head	RR 3, Box 27A Scottsburg, IN 47170 (812) 752-6208	Crothersville Senior High North Preston Crothersville, IN 47229 (812) 793-2051
Pamela Stewart Math Teacher	15120 Hemlock Point Chagron Falls, OH 44022 (216) 338-3597	University School Shaker Heights, OH 44122 (216) 393-1546
Bernita E. Stiles 6th Grade Science Tchr	2014 7th Avenue North Fort Dodge, IA 50501 (515) 573-7857	Fair Oaks Middle School Fort Dodge, IA 50501 (515) 576-3138
Diane Thiel Biology Teacher/ Science Dept. Head	12937 Leech Sterling Hghts,MI 48077 Unpublished	Lincoln High School Warren, MI 48089 (216) 393-1546
Mark W. Thomas Director/Bilingual Tchr	1312 Cliff Drive Santa Cruz, CA 95060 (408) 458-2088	Santa Cruz Gardens Elem. Life Lab 8005 Winkle Avenue Santa Cruz, CA 95060 (408) 476-0525
David Ulmer Science Teacher	1407 Holmes Drive Colo Springs, CO 80909 (303) 633-4400	William Mitchell High 1205 Potter Drive Colorado Springs, CO 80909 (303) 653-6491

1984 ELEMENTARY HONORS WORKSHOP ROSTER
THE UNIVERSITY OF IOWA
June 24 - July 8, 1984

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Claire R. Allen Science/5th	2012 Ashmore Drive Ames, IA 50010 (515) 292-9149	Louise Crawford Elementary 415 Stanton Ames, IA 50010 (515) 292-7422
Maryjean Carlson 2nd Grade Teacher	447 Cavalier Court West Dundee, IL 60118 (312) 428-1626	John Muir School 1973 Kensington Lane Schaumburg, IL 60172 (312) 885-6778
Camilla Dalton Sci Resource Teacher	808 West 19th Anchorage, AK 99503 (907) 272-3344	Anchorage School District 2231 South Bragaw Benson Building Anchorage, AK 99508 (907) 276-8011
Jean M. Hamlin Science Specialist	1138 East Sesame Street Tempe, AZ 85282 (602) 838-3594	Mesa Public Schools Science Resource Center 549 North Stapley Drive Mesa, AZ 85204 (602) 898-7815
Janet M. Hoffey Elementary Teacher	310 Melrose Court Iowa City, IA 52240 (319) 338-8904	Roosevelt Elementary School 611 Greenwood Drive Iowa City, IA 52240 (319) 338-9428
Judy C. Holtz Elem Sci Resource Tchr	6988 NW 9th Way Ft. Lauderdale, FL 33309 (305) 973-7136	Division of Instruction Science Department Ft. Lauderdale, FL 33309 (305) 765-6046
Nancy C. Kyle	2510 Southerest Drive Arlington, TX 76016 (817) 496-0250	
Carmen R. Matos Teacher	3804 Poplar Avenue Brooklyn, NY 11224 (212) 946-0424	CSD #19 Natures's Niche 557 Pennsylvania Avenue Brooklyn, NY 11224 (212) 257-6900 ext 232

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Mary McCurdy Science/Math Teacher	7901 East Avon Lane Lincoln, NE 68505 (402) 464-8136	Morly Elementary School 6800 Monterey Street Lincoln, NE 68505 (402) 488-1331
Kathleen Melander Supr/Dept Head Elem Sci	1026 Warwick Avenue Warwick, RI 02880 (401) 738-6306	Warwick Public Schools Warwick Lane 3400 Warwick Lake Avenue Warwick, RI 02880 (401) 737-3300 ext 267
Michael J. O'Keefe K-6 Science Teacher	Lost Acres Chepachet, RI 02814 (401) 568-8188	Warwick Public Schools Warwick Lane 3400 Warwick Lake Avenue Warwick, RI 02880 (401) 737-3300
Linda J. Ost Sci Resource Teacher	6430 Dena Court Bakersfield, CA 93380 (805) 393-5828	Bakersfield City Sch. Dist. Freemont School Texas Street Bakersfield, CA 93308 (805) 327-3311
James Spevak Undergrad Academic Adv.	1929 Friendship Iowa City, IA 52240 (319) 337-6123	University of Iowa 783 Van Allen Hall Iowa City, IA 52242 (319) 337-6123
Nathan O. Tosten Classroom Tchr/5th	3417 Harcourt Drive Ames, IA 50010 (515) 232-7710	Rooselvelt Elementary Sch. 921 9th Ames, IA 50010 (515) 232-7799
Lauren H. Wilson Elementary Science	18 Brook Avenue Riverside, RI 02915 (401) 437-1623	Cedar Hill Elem. School Warwick, RI 02889 (401) 737-3300
Joanne Wolf Science Specialist	2055 East Hampton #53 Mesa, AZ 85204 (602) 892-0183	Mesa Public School District Resource Center 549 North Stapley Drive Mesa, AZ 85204 (602) 898-7815

1984 MIDDLE/JUNIOR HIGH HONORS WORKSHOP ROSTER
THE UNIVERSITY OF IOWA
June 24 - July 7, 1984

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Sharon E. Bartel 6th Grade Science Tchr.	421 West 9th Cordell, OK 73632 (405) 832-2953	Cordell Elementary Cordell, OK 73632 (405) 832-3220
John A. Bartley Science Supervisor K-12	510 Lafayette Avenue Collingdale, PA 19023 (215) 586-8694	Springfield School Dist. 111 West Leamy Avenue Springfield, PA 19023 (215) 544-5800 ext. 236
Bonnie F. Brunkhorst Physical Sci/8th Grade	547 Great Elm Way Acton, MA 01718 (617) 263-7056	Evans Clark Junior H.S. Stedman Road Lexington, MA 02173 (617) 861-6082
Herbert Brunkhorst Life Sci/7-8th Grade	547 Great Elm Way Acton, MA 01718 (617) 263-7056	Brown Junior H.S. 125 Meadowbrook Road Newton, MA 02148 (617) 552-7049
Sharon S. Close Science Teacher	8774 Chase Drive #34 Arvada, CO 80003 (303) 423-9749	Everett Junior H.S. 3900 Kipling Wheatridge, CO 80033 (303) 421-6910
Hannah L. Edwards Classroom Teacher	459 Zieman Street Prichard, AL 36610 (205) 452-4114	Semmes Middle School Wolf Road Prichard, AL 36610 (205) 649-0641
John S. Francis Classroom Teacher	116 West Sixth Street Muscatine, IA 52761 (319) 263-4793	West Middle School 600 Kindler Avenue Muscatine, IA 52761 (319) 263-0411
David L. Gerlits Classroom Teacher	706 12th Avenue Coralville, IA 52241 (319) 351-8247	Franklin Junior H.S. 300 20th Street N.E. Cedar Rapids, IA 52402 (319) 398-2452
Fred W. Goerisch Science Teacher/7th Gr.	2400 Captain Cook Anchorage, AK 99503 (905) 248-1478	Hanshew Junior H.S. 5577 Abbott Road Anchorage, AK 99503 (905) 346-2111

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Rosamond D. Hilton Sci. Ed. Specialist	3520 Castle Road Woodstock, IL 60098 (815) 338-5286	Nash High School 4837 W. Erie Street Chicago, IL 60644 (815) 287-8373
Ronald E. Jarrell Earth & Life Science	2307 Mercer Drive Cocoa, FL 32926 (305) 631-0824	Clearlake Middle School Clearlake Road Cocoa, FL 32926 (305) 636-4020
Robert E. Lewis Science Teacher/8th	2611 Silverside Road Wilmington, DE 19810 (302) 475-8025	Hanby Junior H.S. Berwin Road Wilmington, DE 19810 (302) 429-4436
Beverly McMillan Middle Sch. Sci. Head	603 SW 7th Marietta, OK 73448 (405) 276-5480	Marietta Middle School 510 Gillian Marietta, OK 73448 (405) 276-3866
Barbara B. Nair Earth Science/7th	6 Warwick Circle Iowa City, IA 52240 (319) 351-7648	Southeast Junior H.S. 2501 Bradford Drive Iowa City, IA 52240 (319) 351-8242
Sulaiman N. Razali Physics & Physical Sci.	408 S. Dubuque Street Iowa City, IA 52240 (319) 354-2312	Grant Wood Area Ed. Agency S/T/S Project Cedar Rapids, IA 52408 (319) 399-6700
Marvin D. Selnes Science/9th	2325 Crestwood Road Sioux Falls, SD 57105 (605) 332-6568	Patrick Henry Junior H.S. 2200 South 5th Avenue Sioux Falls, SD 57105 (605) 332-6568
Robert B. Sigda Science Teacher	37 High Pasture Circle Dix Hills, NY 11746 (516) 421-4557	Walt Whitman High School West Hills Road Huntington Station, NY 11746 (516) 673-1711
Linda Sliefert Science/8th	1512 DeWitt Muscatine, IA 52762 (319) 263-6153	West Middle School 600 Kindler Muscatine, IA 52762 (319) 263-0411
Dana P. VanBurgh Earth Science Tchr.	7805 West Chalk Creek Casper, WY 82604 (307) 234-7243	Dean Morgan Junior H.S. 1440 South Elm Casper, WY 82604 (307) 266-2055

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Daniel Van Gorp Science Coordinator	2957 South Race Denver, CO 80210 (303) 757-2822	Cherry Creek High Schools 9300 East Union Denver, CO 80210 (303) 773-8920
Janet L. Wolanin Environmental Science Teacher	1013 Cherokee Road #3 Louisville, KY 40204 (502) 456-5270	St. Francis School 11000 US Hwy 42 Goshen, KY 40026 (502) 228-1197
Stuart O. Yager Principal	515 East Market Farmer City, IL 61892 (309) 489-5201	Mansfield Junior H.S. McKinley Street Farmer City, IL 61892 (309) 928-9236

1984 GIFTED AND TALENTED HONORS WORKSHOP ROSTER
THE UNIVERSITY OF IOWA
July 8 - July 21, 1984

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Jane R. Abbott Biology Teacher	6 Riverside Avenue Waterville, ME 04901 (207) 872-5097	Colby College Brooklyn Avenue Waterville, ME 04901 (207-873-2751
Sam E. Bates Biology Teacher	169 Indian Creek Drive Levittown, PA 19057 (215) 949-2348	Bensalem Community Schools 4319 Hulmeville Bensalem, PA 19020 (215) 244-2944
James Bodolus Science Teacher	133 Popodickon Drive Boyertown, PA 19512 (215) 367-6031	Boyertown, West Center South Madison Center Boyertown, PA 19512 (215) 367-7779
Cary R. Boyer Biology/Physics Tchr	55 Hillside Drive Neffs, A 18065 (215) 767-6217	Parkland High School Orefield, PA 18069 (215) 395-2021
Arthur S. Broga Science Teacher	420 Wilbur Street Oneida, NY 13421 (315) 363-8497	Robert St. Canastate H.S. Canastate, NY 13002 (315) 697-2003
Linda S. Brown Science Dept. Chairman	130 Carneigie Place Pah, PA 15208 (412) 371-3770	Winchester-Thurston School 555 Moreland Avenue Pah, PA 15213 (412) 578-7500
Mary L. Chattin Contract Sub. Teacher	RR 2, Box 177 Lexington, IN 47138 (812) 889-2072	Scott Co. School Dist. 2 Scottsburg, IN 47170 (812) 752-3624
Hannah L. Edwards Teacher	459 Zieman Street Prichard, AL 36610 (205) 452-4114	Semmes Middle School Wulff Road Prichard, AL 36610 (205) 649-0641
Arthur P. Elbert Biology I & II	293 East Seminole Springfield, MO 65807 (417) 883-0555	Lincoln High School 3710 S. Jefferson Avenue Springfield, MO 65807 (417) 864-3921
Julianne R. Green Science Tchr/Dept. Head	818 Mullen Road NW Albuquerque, NM 87107 (505) 344-1963	St. Pius High School 2240 Louisiana Blvd NE Albuquerque, NM 87110 (505) 883-6870

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Joan W. Hall Middle Sch. Science Teacher	1146 Meadowind Court Cincinnati, OH 45231 (513) 522-7073	Summit County Day School 2161 Grandin Road Cincinnati, OH 45208 (513) 871-7507
Dorothy S. Helms Chemistry Teacher	Route 2, Box 9 China Grove, NC 28023 (704) 857-8251	South Rowan Junior H.S. Route 1 China Grove, NC 28023 (704) 857-1161
Rosamond D. Hilton Teacher	3520 Castle Road Woodstock, IL 60098 (312) 338-5286	Henry H. Nash School 4837 W. Erie Street Chicago, IL 60644 (312) 287-8373
Dallas H. Hunter Biology Teacher	1383 Sanger Street Philadelphia, PA 19124 (215) 289-2674	H.S. of Engineering & Sci. 17th & Norris Philadelphia, PA 19124 (215) 684-2800
Linda Y. Jennings Museum Education Tchr.	6645 Lincoln Drive Philadelphia, PA 19119 (215) 848-3341	Philadelphia Zoo 34th & Girard Avenue Philadelphia, PA 19119 (215) 243-1100
Darlene S. Jones Teacher	6 Evelyn Lane SR Quakertown, PA 18951 (215) 536-0489	Perridge School District 1500 Fifth Street Perkasie, PA 18944 (215) 536-0489
Dona P. Key Classroom Resource Tchr.	2278 Inglewood Springfield, MO 65804 (417) 881-1659	Center for the Gifted 902 Kimbrough Springfield, MO 65804 (417) 864-3987
Katharine M. Lien Biology Teacher	P.O. Box 313 Greenville, NY 12083 (518) 966-8566	Guiderland Central Sch.Dist. Guiderland Center, NY 12084 (518) 456-6200
Joseph Michel Biology Teacher and 7-12 G/T Coordinator	8900 Elliot Avenue So. Bloomington, MN 55420 (612) 854-7846	Richfield High School 7001 Harriet Avenue South Richfield, MN 55423 (612) 861-8245 ext. 385
Carol K. Mohling Co-director/Naturalist	26325 W. 135th Street Olathe, KS 66061 (913) 884-8832	The Prairie Center 26325 W. 135th Street Olathe, KS 66061 (913) 884-8832

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Wendell G. Mohling Outdoor Lab. Director	26325 W. 135th Street Olathe, KS 66061 (913) 884-8832	12701 W. 67th Street Shawnee Mission, KS 66216 (913) 631-4646
Del L. Nusbaum Math & Science/ T&G Teacher	1336 Beacon Grants Pass, OR 97526 (503) 476-5504	Lincoln Savage School 1851 New Hope Road Grants Pass, OR 97526 (503) 862-2171
Evelyn Osherow Teacher--Gifted Grades 3/4/5	1122 Brighton Street Philadelphia, PA 19111 (215) 342-4027	Delron Middle School Chester Avenue Delron, NJ 08075 (609) 461-6100
Gloria A. Pritikin Science Tchr/Co-Chairman	1008 Washington Blvd. Oak Park, IL 60302 (312) 386-6006	Henry H. Nash School 4837 West Erie Chicago, IL 60644 (312) 287-8373
Robert H. Ramgren Chemistry Teacher	800 Lakeview Drive Shoreview, MN 55112 (612) 484-1541	Stillwater High School Marsh Street Stillwater, MN 55082 (612) 439-3694
Judith M. Randals Science Teacher	Box 1025 Cape Canaveral,FL 32290 (305) 784-5694	Kennedy High School Fiske Blvd. Rockledge, FL 32955 (305) 631-9500
Gary Rebbe Science Coordinator	8425 Lotus Skokie, IL 60077 (312) 996-5569	Melody School 412 South Keeler Chicago, IL 60624 (312) 638-1235
Marvin D. Selnes Science Teacher	2325 Crestwood Road Sioux Falls, SD 57105 (605) 332-6568	Patrick Henry High School 2200 South Fifth Avenue Sioux Falls, SD 57105 (605) 339-1540
Walter F. Soule Physics Teacher	70 Raleigh Tavern Lane North Andover,MA 01845 (617) 683-7851	Winchester High School 80 Skillings Road Winchester, MA 01890 (617) 721-7020
Elfriede W. Tillman Teacher	Shaughnessy Road Pleasant Valley,NY 12569 (914) 471-7031	Rt. 55 Freedom Plains Lagrangeville, NY 12540 (914) 724-5840

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
James H. Tomlin Biology Teacher	Box 214B Layton Road Clarks Summit, PA 18411 (717) 587-4905	Wyoming Valley West Wadhams Street Plymouth, PA 18651 (717) 779-5361
Robert L. Tostevin Science Teacher	11 Homestead Drive Coopersburg, PA 18036 (215) 282-3169	William Allen High School 17th & Turner Street Allentown, PA 18104 (215) 820-2223
Sister Xaveria Whittmann Science Instructor	507 E. College Avenue Waukesha, WI 53186 (414) 542-3396	Catholic Memorial School 601 E. College Avenue Wausheha, WI 53186 (414) 542-7101
David A. Wiley Science Instructor	1446 Bristol Road, C-47 Bensalem, PA 19020 Unpublished	Bensalem High School Bensalem, PA 19020 (215) 245-6467
Imogene E. Woods Math/Science for Gifted/ 5th & 6th	Route 2, Box 90-3I Ozark, MO 65721 (417) 725-3384	Center for the Gifted 902 Kimbrough Springfield, MO 65802 (417) 864-3987
Patricia A. Yagecic Science Teacher	4726 B Grant Avenue Philadelphia, PA 19114 (215) 637-7731	Bensalem Community Schools 4319 Hulmeville Road Bensalem, PA 19020 (215) 244-2944
Irvin A. Yudkin Principal	1301 Knorr Street Philadelphia, PA 19111 (215) 342-7984	Lewis Elkin Elem. School "D" Street & Allegheny Ave. Philadelphia, PA 19134 (215) 425-4290
Janet A. Yudkin Teacher	1301 Knorr Street Philadelphia, PA 19111 (215) 342-7984	Lewis Elkin Elem. School "D" Street & Allegheny Ave. Philadelphia, PA 19134 (215) 425-4290
George S.Zahrobsky Science Dept. Chairman	336 May Avenue Glen Ellyn, IL 60137 (312) 469-8682	Glenbaro West High School 670 Crescent Blvd. Glen Ellyn, IL 60137 (312) 469-8600

1984 APPLICATIONS OF SCIENCE HONORS WORKSHOP ROSTER
THE UNIVERSITY OF IOWA
July 8 - July 21, 1984

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Anne E. Barefoot Physics/Chemistry Tchr.	Rt. 1, Box 98 Hallsboro, NC (919) 646-3516	Whiteville High School Lee Street Whiteville, NC 28472 (919) 642-8054
Alta J. Barker Teacher	P.O. Box 318 Grant, FL 32949 (305) 725-7343	Port Malabar School 1241 SW Addison Street Palm Bay, FL 32907
Clayton R. Barker Classrm. Tchr.	P.O. Box 318 Grant, FL 32949 (305) 725-7343	Palm Bay Elementary Sch. 515 Allamanda Road Palm Bay, FL 32907 (305) 723-1005
Donald L. Birdd Assoc. Professor of Science Education	27 Parke Dr.,Fountain Pk. Richmond, KY 40475 (606) 624-0794	Eastern Kentucky Univ. Model Laboratory School Richmond, KY 40475 (606) 622-3766
John D. Butler 3rd Grade Teacher	SR Box 21 Monte Road Eagle River, AK 99577 (907) 694-3069	Eagle River Elementary Bragaw Street Anchorage, AK 99577 (907) 694-2225
Nancy L. Dickman Physics/Chemistry Tchr.	412 B Jaysville Lane #1 Iowa City, IA 52240 (319) 354-4283	Marion High School 2200 North 10th Street Marion, IA 52302 (319) 337-7373
Bill A. Feldon Classrm. Tchr.	2907 Fairway Drive Melbourne, FL 32901 (305) 727-7907	Meadow Lane Elem. School 225 Minton Road West Melbourne,FL 32901 (305) 723-6354
Jose D. Florez Chemistry Teacher	3314 East Whiteside Springfield, MO 65804 (417) 883-2349	Kickapoo High School 3706 South Jefferson Springfield, MO 65807 (417) 864-3921
Gerald E. Friday Biology Teacher	4165 North 80th Street Milwaukee, WI 53222 (414) 461-1106	Marquette High School 3401 W. Wisconsin Avenue Milwaukee, WI 53208 (414) 933-7200

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Steven M. Giere Biology/Science Dept.	P.O. Box 718 Brookings, OR 97415 (503) 469-4924	Brookings-Harbor H.S. P.O. Box 640 Brookings, OR 97415 (503) 469-2108
Bruce D. Hogue Jr. High Science Tchr/	3844 South Grant Englewood, CO 80110 (303) 789-1130	Johnston Junior H.S. 1855 Southwright Street Englewood, CO 80110 (303) 985-1545
Karen A. Johnson Earth Science Tchr.	2117 Trieste Drive Mims, FL 32754 (305) 268-4446	Johnson Junior H.S. 2255 Croton Road Melbourne, FL 32901 (305) 259-3341
David V. Keene 6th Grade Science Tchr.	4465 Lee Street Cocoa, FL 32916 (305) 631-7396	Meadow Lane Elem. School 225 Minton Road West Melbourne, FL 32901 (305) 723-6354
Joyce P. Merriwether Teacher	10744 South Sangamon Chicago, IL 60643 (312) 631-7396	Brennan Elementary School 11411 S. Eggleston Chicago, IL 60643 (312) 821-2741
Jack E. Neal Biology Teacher	512 W. Lemon Street Lancaster, PA 17603 (717) 392-8260	McCaskey High School 445 N. Reservoir Street Lancaster, PA 17602 (717) 291-6211
Sandra L. Neal High School Teacher	512 W. Lemon Street Lancaster, PA 17603 (717) 392-8260	McCaskey High School 445 N. Reservoir Street Lancaster, PA 17602 (717) 291-6211
Ronald L. Newland Physics/Chemistry Tchr.	733 West 7th Street Monticello, IA 52310 (319) 465-5143	Monticello Schools 217 South Maple Street Monticello, IA 52310 (319) 465-4255
Jean B. O'Quinn Elementary Teacher	2685 Lake Hill Road Melbourne, FL 32935 (305) 254-6128	Sherwood Elementary Sch. 900 Post Road Melbourne, FL 32901 (305) 254-6424
Anne V. Pitchell Life Science Teacher	1900 Poinsetta Blvd. Melbourne, FL 32935 (305) 724-2409	Johnson Junior High School Croton Road Melbourne, FL 32901 (305) 259-3338

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Antoinette Rubalcaba Teacher	1448 West Chestnut Chicago, IL 60622 (312) 278-1684	Inter American Magnet Sch. 901 West Barry Avenue Chicago, IL 60657 (312) 525-4604
Robert J. Snavely Curriculum Coordinator	1606 North 29th Street Sheboygan, WI 53081 (414) 457-9402	Kohler Schools Kohler, WI 53044 (414) 457-9404
Danielle M. Spaete Physics/Biology Tchr.	1006 Fourth Street DeWitt, IA 52742 (319) 659-8516	Pleasant Valley High School Belmont Road Pleasant Valley, IA 52767 (319) 332-5151
Leonard Sparks Museum Educator	379 Wyandette, #2 Columbus, OH 43202 (614) 268-0922	COSI 280 E. Broad Street Columbus, OH 43215 (614) 228-6362
Arlyn D. Thomas Teacher	2411 Carter Place Sioux Falls, SD 57105 (605) 338-2030	Patrick Henry Junior High 2400 South 5th Avenue Sioux Falls, SD 57105 (605) 339-1540
Richard Tompkins Instructor	1614 Sanford Drive Iowa Falls, IA 50126 (319) 273-2311	University of No. Iowa Cedar Falls, IA 50613 (515) 648-3521
Ilene J. Wagner 4th Grade Teacher	5220 North Winthrop Chicago, IL 60640 (312) 271-7203	Henry H. Nash School 4837 West Erie Chicago, IL 60644 (312) 287-8372
Michael J. Weller K-12 Guidance	Box 384 Sunburst, MT 39482 (406) 937-6030	North Toole County School Box 710 Sunburst, MT 59482 (406) 937-2811
Susan H. Weller Resource Room Aide	Box 384 Sunburst, MT 59482 (406) 937-6030	Bitterroot Elementary Sch. 622 North Granite Shelby, MT 59474 (406) 937-5591
Patricia S. Whitfield 7th Grade Life Science/ Department Chairman	1514 Anglers Drive Palm Bay, FL 32905 (305) 727-3663	Stone Middle School 1101 University Blvd. Melbourne, FL 32901 (305) 723-0741

1984 LEADERSHIP HONORS WORKSHOP ROSTER
THE UNIVERSITY OF IOWA
June 9 - June 23, 1984

Name	Home Address Home Telephone	Professional Address Professional Telephone
Jane R. Abbott	6 Riverside Avenue Waterville, ME 04901 (207) 872-5097	Colby College Brooklyn Avenue Waterville, ME 04901 (207) 873-2751
Bill G. Aldridge	531 N. Lombardy Arlington, VA 22203 (713) 522-0602	1742 Connecticut Avenue Washington, D.C. 20009 (202) 328-5800
John Carpenter	1719 Koulter Drive Columbia, SC 29210 (803) 772-1839	University of So. Carolina Department of Geology Columbia, SC 29208 (803) 777-6920
William R. Cary	881 Terry Place Madison, WI 53711 (608) 233-2262	Memorial High School 201 S. Gammon Road Madison, WI 53717 (608-833-2020 ext 263
Richard C. Clark	3020 St. Albans Mill Rd. 550 Cedar Street St. Paul, MN 55101	Minnesota Dept. of Ed. Minnetonka, MN 55343 (612) 542-9885
Kenneth W. Dowling	7974 Old Sauk Pass Rd. Cross Plains, WI 53578 (608) 836-7165	Dept. of Public Instruction 125 South Webster Box 7841 Madison, WI 53707 (608) 266-3319
Marvin Druger	114 Ramsey Avenue Syracuse, NY 13210 (315) 446-4543	Syracuse University 214 Lyman Hall Syracuse, NY 13210 (315) 423-3820
I. Dwaine Eubanks	2413 N. Husband Place Stillwater, OK 74075 (405) 377-0871	Oklahoma State University University Center for Effective Instruction Stillwater, OK 74078 (405) 624-5000
Joseph D. Exline	Route 9, Box 47 Mechanicsville, VA 23111 (804) 746-4995	Virginia Dept. of Ed. P.O. Box 6Q Richmond, VA 23216 (804) 225-2657

Name	Home Address Home Telephone	Professional Address Professional Telephone
Thomas P. Evans	5055 NE Elliot Circle Corvallis, OR 97331 (503) 754-1095	Oregon State University Science Education Dept. Corvallis, OR 97331 (503) 754-4031
Darrel W. Fyffe	1374 Clough Street Bowling Green, OH 43402 (419) 352-6197	Bowling Green State Univ. 126 Life Science Building Bowling Green, OH 43403 (419) 372-5231
J. J. Gallagher	2146 Riverwood Okemos, MI 48864 (517) 349-1855	Michigan State University 327 Erickson Hall East Lansing, MI 48824 (517) 355-1725
Jack A. Gerlovich	6400 Robin Drive Des Moines, IA 50322 (515) 276-6472	Dept. of Public Instruction Grimes State Office Bldg. Des Moines, IA 50310 (515) 281-3249
Lynn W. Glass	745 18th Street Nevada, IA 50201 (515) 382-4843	Iowa State University N156 Quadrangle Ames, IA 50010 (515) 294-7006
Faith Hickman	1610 Sunset Drive Louisville, CO 80027 (303) 666-6020	University of Colorado Campus Box 249 Boulder, CO 80309 (303) 492-6392
Ann C. Howe	1107 Harvey Street Raleigh, NC 27608 (919) 831-4131	Math & Science Education North Carolina St. Univ. Raleigh,NC 27695-7801 (919) 737-2238
Phyllis Huff	7928 Hayden Drive Knoxville, TN 37919 (615) 693-7086	University of Tennessee CEB 205 Knoxville, TN 37916 (615) 974-2541
Roger Johnson		University of Minnesota 370 Peik Hall Minneapolis, MN 55455
Edward E. Jones	111 Acorn Circle Oxford, OH 45056 (513) 523-6523	Miami University Oxford, OH 45056 (513) 529-4927

Name	Home Address Home Telephone	Professional Address Professional Telephone
Marjorie M. King	2128 Guardian Avenue Gretna, LA 70053 Unpublished	519 Huey P. Long Avenue Gretna, LA 77053 (504) 367-3120
Vincent N. Lunetta		Science Education University of Iowa Iowa City, IA 52242
Robert W. Menefee	9100 Tuckahoo Lane Adelphi, MD 20783 (301) 439-9113	Montgomery College Natural Science Takoma Park, MO 20912 (301) 587-4090 ext. 310
Joseph P. Meyer	551 Poplar Street Elmhurst, IL 60126 (312) 941-9404	Oak Park River & Forest H.S. 201 N. Scoville Avenue Oak Park, IL 60302 (312) 383-0700
Alan J. McCormack	1757 North 15th Street Laramie, WY 82070 (307) 742-7416	Zoology & Science Education University of Wyoming Laramie, WY 82071 (307) 766-4384
Alice J. Moses	5726 So.Drexel Ave. Chicago, IL 60637 (312) 493-3965	University of Chicago Laboratory Schools 1362 East 59th Street Chicago, IL 60637 (312) 962-9444
LaMoine L. Motz	2890 N. Lake Angeles Rd. Pontiac, MI 48055 (313) 673-6414	Oakland Schools 2100 Pontiac Lake Roads Pontiac, MI 48054 (313) 858-1992
John Penick	733 S. Summit Iowa City, IA 52240 (319) 338-1469	Science Education University of Iowa Iowa City, IA 52242 (319) 353-4922
E. Joe Piel	192 Gould Avenue N. Caldwell, NJ 07006 (201) 226-4878	State University of N.Y. College of Engineering Stonybrook, NY 11794 (516) 239-8950
Jerry Resnick	2750 Homecrest Avenue Brooklyn, NY 11235 (212) 769-4792	Edward R. Murrow H.S. Office of the Superintendent 1600 Avenue "L" Brooklyn, NY 11230 (212) 258-4177

Name	Home Address Home Telephone	Professional Address Professional Telephone
James Shymansky	406 Magowan Avenue Iowa City, IA 52240 (319) 351-7988	Science Education Center 405B Van Allen Hall Iowa City, IA 52242 (319) 353-3600
Robert B. Sigda	37 High Pasture Circle Dix Hills, NY 11746 (516) 421-4557	Walt Whitman H.S. West Hills Road Huntington Station, NY 11746 (516) 673-1711
Sterling L. Smith	906 Clearview Krum, TX 76249 (817) 566-2707	Texas Woman's University Biology Department Denton, TX 76204 (817) 566-2907
Ertle Thompson	308 Montebello Circle Charlottesville,VA 22903 (804) 293-7330	School of Education University of Virginia 405 Emmet Street South Charlottesville, VA 22903 (804) 924-3738
Gilbert L. Twiest	RD 1 Clarion, PA 16214 (814) 764-5353	Clarion University Center for Science Education Clarion, PA 16214 (814) 226-2163
Barry VanDeman	P.O. Box 314 Frankfort, IL 60423 (815) 469-5078	Museum of Sci. & Industry 57 St.& Lake Shore Drive Chicago, IL 60637 (312) 684-1414
Jan S. Wielert	1303 Dolen Place Iowa City, IA 52240 (319) 338-5667	West High School 2901 Melrose Avenue Iowa City, IA 52240 (319) 351-4550

1985 HONORS WORKSHOP ROSTER
SCIENCE/TECHNOLOGY SOCIETY HONORS WORKSHOP
THE UNIVERSITY OF IOWA
Iowa City, Iowa 52242
July 21-August 3, 1985

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Bill Barnes Science Dept. Head/ Science Teacher	1678 Cherry Lane Layton UT 84041 (801) 544-8544	North Layton Junior High 1100 West 2000 North Layton, UT 84041 (801) 773- 4256
Carl L. Bruce Science/Math Curriculum	3073 North 1225 East Ogden, UT 84404 (801) 782-3073	Bonneville High School 251 East 4800 South Ogden, UT 84403 (801) 394-6661
Jean Burkus Science Dept. Head/ Science Teacher	46 Spring Valley Road Woodbridge, CT 06525 (203) 393-1886	Amith Regional Jr. High Ohman Avenue Orange, CT 06477 (203) 397-9235
Betty T. Cox County Curriculum Coordinator	3130 Riviera Drive Key West, FL 33040 (305) 296-2528	Monroe County School Board 242 White Street Key West, FL 33040 (305) 296-6523
Otha P. Cox Assistant Superintendent	3130 Riviera Drive Key West, FL 33040 (305) 296-2528	Monroe County School Board 242 White Street Key West, FL 33040 (305) 296-6523 ext. 135
Frances E. Crawford Science Teacher	1209 Quail Run Columbia, SC 29206 (803) 782-2592	Richland Northeast High 7500 Brookfield Road Columbia, SC 29223 (803) 788-6911
Linda W. Crow Science Teacher	18919 Casper Spring, TX 77373 (713) 353-9312	Houston Comm.College System 22 WaughDrive Houston, TX 77007 (713) 868-0758
Diana D. Doepken Teacher	7755 Delmonico Drive Colorado Springs, CO 80919 (303) 593-9474	Air Academy High School USAF Academy, CO 80840 (303) 472-1295
Orwin Draney Science Dept. Head	249 North 800 East Kaysville, UT 84037 (801) 544-8278	Mound Fort Middle School 1396 Liverty Avenue Ogden, UT 84404 (801) 399-3456

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Paula M. Edwards Science Dept. Head/ Science Teacher	2541 Gilpin Court Loveland, CO 80537 (303) 669-9437	Reed Junior High School 370 W. Fourth Street Loveland, CO 80537 (303) 667-5137
Earl G. Gordon Principal/ Curriculum Designer	Box 644 616 Grafton Street Esparto, CA 95627 (916) 787-3710	Esparto High School 600 Yolo Avenue Box 69 Esparto, CA 95627 (916) 787-3405
Carole R. Goshorn Science Teacher	2554 California Street Columbus, IN 47201 (812) 376-0409	Columbus East High School 230 South Marr Road Columbus, IN 47201 (812) 376-4350
Robert L. Hillier Science Teacher	2135 West 1070 North Layton, UT 84041 (801) 544-3316	Sunset Junior High 1610 North 150 West Sunset, UT 84015 (801) 825-0854
Tina Koepnick Science Teacher	4 Southridge Court Coralville, IA 52241 (319) 338-9407	Prairie High School 401 76th Avenue Cedar Rapids, IA 52401 (319) 848-4121
Greg Lewis Science Dept. Head	1695 East 1250 South Ogden, UT 84404 (801) 621-4190	Central Middle School 781 25th Ogden, UT 84401 (801) 399-3456 ext. 292
Ann Rivers Mack Science Teacher	658 Amelia Webster Groves,MO 63119 (314) 962-7752	Kirkwood High School 801 W. Essex Kirkwood, MO 63122 (314) 966-5700 ext. 1277
Robert D. McAloon Science Teacher	908 Bell Avenue Sheboygan, WI 53081 (414) 458-4046	Urban Middle School 1226 North Avenue Sheboygan, WI 53081 (414) 459-3677
Evelyn Mitchell Science Dept. Head	1835 S. 139th Street Omaha, NE 68144 (402) 333-7668	Mercy High School 150 S. 48th Street Omaha, NE 68106 (402) 553-9424
Louis J. Nicolosi Section Chief, Social Studies	104 Hynes Drive Plaquemine, LA 70764 (504) 687-6651	Louisiana Dept. of Education Box 94064 Baton Rouge, LA 70804

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Virginia Ord Science Teacher	980 East Arlington Way Bountiful, UT 84010 (801) 295-5106	Millcreek Junior High 245 East 1000 South Bountiful, UT 84010 (801) 298-2251
John T. Owen Science Dept. Head	Box 114 42 W. Custer Aberdeen, ID 83210 (208) 397-4876	Aberdeen High School Box 610 Aberdeen, ID 83210 (208) 397-4152
Gary Reed Science Teacher	1085 Mountain Road Ogden, UT 84404 (801) 394-2845	Roy High School 2150 West 4800 South Roy, UT 84067 (801) 825-9766
R. Chris Rohde Science Teacher/ Curriculum Asst.	904 Miles Street Chippewa Falls, WI 54729 (715) 723-8056	Chippewa Falls Senior High 735 Terrill Street Chippewa Falls, WI 54729 (715) 723-5551
Maxine K. Saddler Teacher	3644 South Poplar Street Denver, CO 80237 (303) 758-5629	Samuels Elementary School 3985 S. Vincennes Court Denver, CO 80237 (303) 770-2215
Donald B. Shepherd Science Teacher	Box 112 Maple Falls, WA 98266 (206) 599-2935	Mt. Baker High School Box 95 Deming, WA 98244 (206) 592-5151
Patricia J. Smith Science Dept. Head	7512 Gillen Road Colorado Springs, CO 80919 (303) 599-0462	Air Academy High School USAF Academy, CO 80840 (303) 472-1295
Barbara Snyder Science Teacher	2110 West Bay Drive Muscatine, IA 52761 (319) 263-0299	West Middle School 600 Kindler Muscatine, IA 52761 (319) 263-0411
Brent Thurgood Science Dept. Head	6300 West 6000 South Hooper, UT 84315 (801) 825-1742	Roy Junior High 5400 South 2100 West Roy, UT 84067 (801) 825-1605
David C. Tucker Science Teacher	2618 Huron Street Bellingham, WA 98226 (206) 676-7013	Mt. Baker High School Box 95 Deming, WA 98244 (206) 592-5151

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Emma L. Walton Science Curriculum Specialist	2014 Crataegus Circle Anchorage, AK 99508 (907) 279-9918	Anchorage School District Pouch 6-614 Anchorage, AK 99502 (907) 269-2274
David A. Wiley Science Teacher	1446 Bristol Road C-47 Bensalem, PA 19020 (215) 245-6467	Bensalem High School 4319 Hulmeville Road Bensalem, PA 19020 (215) 244-2929

1985 HONORS WORKSHOP ROSTER
ELEMENTARY SCIENCE
UNIVERSITY OF WYOMING

Laramie, Wyoming 82071
August 4 - August 17, 1985

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Nancy Booth First Grade Teacher	5401 Sudbury Way Madison, WI 53714 (608) 244-2580	Deerfield Elementary 10 S. Liberty Deerfield, WI 53531 (608) 764-5442
Donald Max Brown Principal	629 Salem Avenue Rolla, MO 65401 (314) 364-8442	Wyman Elementary School 402 Lanning Lane Rolla, MO 65401 (314) 364-5205
Dwight G. Brown Science Dept. Head	791 East 550 North Bountiful, UT 84010 (801) 292-5336	Mueller Park Junior High 955 East 1800 South Bountiful, UT 84010 (801) 295-8515
Emily V. Carpenter Fourth Grade Teacher	8927 46th Drive NE Box 66 Marysville, WA 98270 (206) 659-5773	Explorer Elementary 9600 Sharon Drive Everett, WA 98204 (206) 355-5214
Mary Lynn Chattin Science Teacher	RR 2, Box 177 Lexington, IN 47138 (812) 889-2072	Scottsburg Junior High South Third Street Scottsburg, IN 47170 (812) 752-3624
Barbara Clark Fifth Grade Teacher	Box 196 Stuart, OK 74570 (918) 546-2354	Checotah Elementary Checotah, OK 74426 (918) 473-5832
Sandra J. Colby Fifth/Sixth Grade Teacher	6690 Devinney Ct. Arvada, CO 80004	Juchem Elementary 9950 Yarrow Broomfield, CO 80020 (303) 466-1931
A. Rick Davis Science Coordinator	Box 3140 Pago Pago, American Samoa 96799 (684) 699-1132	Department of Education Pago Pago American Samoa 96799 (684) 633-1246
Gail C. Foster Teacher	10283 West Marlow Pl. Littleton, CO 80123 (303) 979-2692	Energy Management Center Box 190 Port Richey, FL 33568 (813) 848-4881

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Fred Goerisch Science Teacher	2400 Captain Cook Anchorage, AK 99503 (907) 248-1478	Hanshew Junior High Anchorage, AK 99500 (907) 349-1561
Jean Hamlin Science Specialist	1138 E. Sesame Street Tempe, AZ 85283 (602) 838-3594	Mesa Public Schools Science Resource Center 143 S. Alma School Road Mesa, AZ 85202
Donald R. Iman Science Dept. Head/	11591 W. Mountain View Tracy, CA 95376 (209) 836-4334	Livermore High School 600 Maple Street Livermore, CA 94550 (415) 447-3112
Jenepher Lingelbach Director of Education	RR 2, Box 102 South Royalton, VT 05068 (802) 763-7058	Vermont Institute of Natural Science Church Hill Woodstock, VT 05091 (802) 457-2779
Masso Matsumoto Project Disseminator	1400 Fulton Avenue Monterey Park, CA 91754 (818) 288-9468	L. A. Unified School Dist. Physical Anthropology Center 6625 Balboa Boulevard Van Nuys, CA 91406 (818) 997-2389
Thomas Matthews Teacher	HCR Box 8-A Greeley, PA 18425 (717) 685-7365	Shohola Elementary School Twin Lakes Road Shohola, PA 18458 (717) 559-7633
Charlotte J. McDonald Fifth Grade Teacher	11917 W. 143rd Street Olathe, KS 66062 (913) 897-9630	Morse Elementary 15201 Halsey Olathe, KS 66062 (913) 897-3810
Vicki L. Moon First Grade Teacher	3025 Florida Avenue Melbourne, FL 32901 (305) 723-9494	Port Malabar Elementary 301 Pioneer Avenue NE Palm Bay, FL 32907 (305) 725-0070
Jane D. Nall Science Dept. Head/ Teacher	Route 3, Box 110A Atmore, AL 36502 (205) 368-2826	Escambia Co. High 1215 S. Presley Atmore, AL 36502 (205) 368-999181
Meredith Olson Science Dept. Head	4262 NE 125 Seattle, WA 98125 (206) 362-2265	Seattle County Day 2619 Fourth North Seattle, WA 98109 (206) 284-6220

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Lorrena M. Preble Science Teacher	K G Ranch Road Hope Valley, RI 02832	Greenwood/Potowomut Sch. Warwick Avenue Warwick, RI (401) 737-3300
John G. Samuels Science and Health Coordinator	55 Highland Road #605 Bethel Park, PA 15102 (412) 835-0539	Peters Twp Curriculum Ctr. 625 E.mcMurray Road McMurray, PA 15317 (412) 941-6272
Clifford L. Schrader Science Dept. Head/ Teacher	RR 4, Box 4078 New Philadelphia, OH 44663 (216) 343-9327	Dover High School 520 N. Walnut Street Dover, OH 44622 (216) 343-7746
Jerry J. Schweitzer Fifth Grade Teacher	4005 E. Edgewood Ave. Mesa, AZ 85206 (602) 830-5565	Robson Elementary 2122 E.Pueblo Mesa, AZ 85204 (602) 898-0955
Robert B. Sigda Science Teacher	37 High Pasture Circle Dix Hills, NY 11746 (516) 673-1711	Walt Whitman High School West Hills Road Huntington Station, NY 11746 (516) 421-4557
Carol C. Snell Teacher/Training Specialist	111 W. Van Buren Drive Holiday, FL 33590 (813) 937-9527	Energy Management Center Box 190 Port Richey, FL 33568 (813) 848-4870
Steven O. Spurger Teacher/Specialist	Rt. 2, Box 24K-4 Trinity, TX 75862 (409) 594-5773	Outdoor Education Center Route 2, Box 25B-1 Trinity, TX 75862 (409) 594-2541
John M. Stark Program Leader I	Rt. 2, Box 25B Trinity, TX 75862 (409) 594-9655	Outdoor Education Center Route 2, Box 25B-1 Trinity, TX 75862 (409) 594-2541
Terry C. Switzer Program Manager	15 Scott Drive Brooksville, FL 33526 (813) 856-2581	Energy Mangement Center Box 190 Port Richey, FL 33568 (813) 848-4870
Marilyn Szymaszek Teacher	258 Kensington Avenue Apt. 2 Meriden, CT 06450 (203) 235-8545	Sheehan High School Hope Hill Road Wallingford, CT 06492 (203) 265-2831 ext. 322

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Bonita Talbot Teacher	3961 Hunters Hill Way Minnetonka, MN 55345 (612) 475-1409	Excelsior Elementary 441 Oak Street Excelsior, MN 55331 (612) 474-2564
Doris L. Tilly Science Coordinator, Grades 1-5	2609 Caladium Dr. NE Atlanta, GA 30345 (404) 938-6324	Westminster Schools 1424 W. Paces Ferry Rd. NW Atlanta, GA 30327 (404) 355-8673
Samuel E. Wilson, III Teacher	437 Sierra Vista Lane Valley Cottage, NY 10989 (914) 353-0549	Clarkstown High School Demarest Mill Road West Nyack, NY 10994 (914) 623-9171
JoAnne Wolf Science Specialist	461 W. Holmes #241 Mesa, AZ 85202 (602) 890-2970	Mesa Public Schools Science Resource Center 127 S. Alma School Road Mesa, AZ 85202 (602) 898-7815

1985 HONORS WORKSHOP ROSTER
MIDDLE/JUNIOR HIGH
UNIVERSITY OF ARIZONA

Tucson, AZ 85721
July 14-27, 1985

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Richard R. Bell Science Dept. Head/ Science Teacher	3324 Beechwood Drive Lithia Springs, GA 30057 (404) 944-8155	Turner Middle School 7101 Junior High Drive Lithia Springs, GA 30057 (404) 941-1262
James E. Bodolus Science Teacher	133 Popodickon Drive Boyertown, PA 19512 (215) 367-6031	Boyertown West Center South Madison Street Boyertown, PA 19512 (215) 367-7779
Philip E. Bradney Vice-Principal/ Administrator Grades 6-12 Science	8 Elmwood Lane Painted Post, NY 148870 (607) 962-4232	Corning Free Academy M.S. 11 W. 3rd Street Corning, NY 14830 (607) 936-3788
Laurelynn Brooks Science Teacher	323 1/2 Holtby Road Bakersfield, CA 93304 (805) 325-9653	Fruitvale Junior High 2114 Calloway Drive Bakersfield, CA 93308 (805) 589-3993
Bonnie F. Brunkhorst Science Teacher	3392 Sparkler Drive Huntington Beach, CA 92649	School of Education California State University 5500 University Parkway San Bernardino, CA 92407 (714) 887-7571
Robert O. Carpenter Teacher/Dept. Head	10509 Placita Los Reyes Tucson, AZ 85748 (602) 885-3152	Secrist Middle School 3400 S. Houghton Road Tucson, AZ 85730 (602) 296-6188
Sam S. Chattin Dept. Head	R. R. #2, Box 177 Lexington, IN 47138 (812) 889-2072	Scottsburg Junior High South Third Street Scottsburg, IN 47170 (812) 752-3624
Lorraine M. Conway Science Teacher	285 Millbrook Farm Rd. Marietta, GA 30067 (404) 971-0445	Pine Mountain Middle School Pine Mountain Circle Kennesaw, GA 30144 (404) 427-8171

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Vivian Barbee Coxe Teacher	4744 B. Courtney Lane Raleigh, NC 27604 (919) 876-1690	Millbrook Senior High 2201 Spring Forest Road Raleigh, NC 27604 (919) 876-1473
Rich Davey Science Teacher	2310 55th Street #B Missoula, MT 59803 (406) 251-4789	Havre High School Havre, MT 59501 (406) 243-5344
Carolyn Farnsworth Dept. Head/Science/ Computer Teacher	3204 Northwest Blvd. Columbus, OH 43221 (614) 457-6541	Jones Middle School 2100 Arlington Avenue Upper Arlington, OH 43221 (614) 486-0621 ext. 240
Susan Floore Project Manager Math/Science Support Project	3822 26th Street San Francisco, CA 94131 (415) 285-4692	Parkside Center 2550 25th Avenue San Francisco, CA 94116 (415) 731 6616
Joan W. Hall Science Teacher	1146 Meadowind Court Cincinnati, OH 45231 (512) 522-7073	Summit County Day School 2161 Grandin Road Cincinnati, OH 45208 (513) 871-7507
Richard M. Hall Science Dept. Head/ Science Teacher	1167 Judson Street Redlands, CA 92374 (714) 793-7875	Moore Junior High School 1550 East Highland Avenue Redlands, CA 92373 (714) 793-2857
Sherry L. Hanson Science Teacher	127 11th Avenue W., #11 Dickinson, ND 58601 (701) 225-1147	Hagen Junior High Box 1057 Dickinson, ND 58601 (701) 225-5117
Judi Hazen Science Teacher	720 Adams Avenue Livermore, CA 94550 (415) 447-7823	Junction Avenue Middle Sch. 298 Junction Avenue Livermore, CA 94550 (415) 447-3583
Thomas P. Knorr, Sr. Science Teacher	215 N. Robinson Ave. Pen Argyl, PA 18072 (215) 863-4709	Pen Argyl Area High School 501 W. Laurel Avenue Pen Argyl, PA 18072 (215) 863-9093
Kathleen D. May Science Teacher	6406 N. Walrond Gladstone, MO 64119 (816) 454-4814	New Mark Middle School 515 NE 106th Kansas City, MO 64155 (816) 734-8900

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Marcie McKinnell Teacher	701 W. 17th Hutchinson, KS 67501 (316) 669-9043	North Reno 1616 N. Wilshire Hutchinson, KS 67501 (316) 662-4573
Marv Mikesh Science Dept. Head/ Science Teacher	802 15th Street NW Rochester, MN 55901 (507) 285-1116	John Adams Junior High 1525 31lst Street NW Rochester, MN 55901 (507) 285-8858
Joreen Piotrowski Science Teacher	62 Eustis Street Cambridge, MA 02140 (617) 354-0703	Newman Middle School 1155 Central Avenue Needham, MA 02192 (602) 444-4100 ext. 210
Marylou Rankin Science Teacher	380 S. Tieston Lane Tucson, AZ 85711 (602) 747-2036	Fickett Junior High 7240 E. Calle Arturo Tucson, AZ 85712 (602) 721-0331
Marvin D. Selnes Science/Computer Teacher	2325 Crestwood Road Sioux Falls, SD 57105 (605) 332-6568	Patrick Henry Junior High 2200 S. Fifth Avenue Sioux Falls, SD 57105 (605) 331-7639
Roger L. Spratt Teacher Specialist Health/Science/Math	1301 Johnson Ames, IA 50010 (515) 232-4476	Ames Community Schools 120 South Kellogg Ames, IA 50010 (515) 232-3400 ext. 26
Margaret F. Steinheimer Science Teacher	12311 Harflo Lane St. Louis, MO 63131 (314) 965-8327	Pattonville Hgts. Middle Sch. 195 Fee Road Maryland Heights, MO 63043 (314) 730-5000
Gloria J. Sternberg Science Teacher	Box E Rancho Linda Vista Oracle, AZ 85623 (602) 896-9574	Oracle Middle School Box 588 Oracle, AZ 85623 (602) 896-2431
Donna R. Stump Science Teacher	4234 Columbia Road Martinez, GA 30907 (404) 836-1834	Columbia Middle School 6000 Columbia Road Grovetown, GA 30907 (404) 541-2424
Betty Sue Tow Science Teacher	Route 1, Box 545 Marietta, OK 73448 (405) 276-2803	Marietta Middle School Box 289 Marietta, OK 73448 (405) 276-3886

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Larry L. Turner Science/History Teacher	1720 Albion Place P.O. Box 1797 Davis, CA 95617 (916) 756-3314	Oliver Wendell Holmes Jr. H. 1220 Drexel Drive Davis, CA 95616 (916) 756-5250
S. Thompson Walker Science/Math Teacher	155 Oakdale Avenue Mill Valley, CA 94941 (415) 388-8480	Mill Valley Middle School 425 Sycamore Avenue Mill Valley, CA 94941 (415) 388-7221
Kathleen O. White Science Teacher	5742 E. Bellevue Tucson, AZ 85712 (602) 885-6067	Manzinita Elem. School 3000 E. Manzinita Tucson, AZ 85712 (602) 299-6426
Karen D. Withrow Science Teacher	34395 SE Duus Rd. #38 Estacada, OR 97023 (503) 630-4959	Estacada Junior High Box 519 Estacada, OR 97023 (503) 630-6871 ext. 229

1985 HONORS WORKSHOP ROSTER
SCIENCE FOR THE GIFTED AND TALENTED
TEMPLE UNIVERSITY--Philadelphia, PA 19122
July 14-27, 1985

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Norman E. Anderson Science Teacher	320 Burnett Drive Cedar Falls, IA 50613 (319) 266-6649	Cedar Falls High School Tenth & Division Cedar Falls, IA 50613 (319) 277-3100 ext. 24
David C. Arlander Science Teacher	2342 Northern Hills Ct. Rochester, MN 55904 (507) 289-8231	John Adams Junior High 1525 NW 31st Street Rochester, MN 55901 (507) 285-8858
Leon Borowski Science Dept. Head/ Science Teacher	1610 Ridgewood Road Alamo, CA 94507 (415) 837-1801	Monte Vista High 3131 Stone Valley Road Danville, CA 94526 (415) 820-2900 ext. 222
Linda R. Bostick Science Teacher--Gifted	561 Woodington Road Marietta, GA 30067 (404) 953-2388	Riverwood High School 5900 Heards Drive Atlanta, GA 30328 (404) 252-1772
Nancy Brewer Science Teacher	2023 Oak Street San Francisco, CA 94132 (415) 752-7934	Lowell High School 1101 Eucalyptus San Francisco, CA 94132 (415) 752-7934
Paul G. Canny Facilitator, Gifted/ Computer Teacher	3000 South 41st Street Lincoln, NE 68506 (402) 488-7005	Arnold School 5300 W. Knight Drive Lincoln, NE 68524 (402) 470-2244
Susan G. Carpenter Teacher	711 12th Street Bellingham, WA 98225 (206) 734-0660	Nooksack Valley Primary 1024 Lawson Street Sumas, WA 98295 (206) 988-9423
Carol B. Collins Science Teacher	15817 Country Lake Dr. Tampa, FL 33624 (813) 961-1501	Jefferson High School 4401 W. cypress Tampa, FL 33607 (813) 877-0521
Dian Combs Facilitator, Gifted	302 S. Tracy Clearwater, KS 67026 (316) 584-2404	Clearwater Grade Sch. Annex Clearwater, KS 67026 (316) 584-6317

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Tedd Leon Davis Science Teacher	109 B. Sierra Place Sequim, WA 98382 (206) 683-9276	Port Townsend High 1610 Blaine Port Townsend, WA 98368 (206) 385-2121
Beulah P. Durr Science Teacher	3400 E. Genesee Street Syracuse, NY 13214 (315) 446-4102	William Nottingham H.S. 3100 E. Genesee Street Syracuse, NY 13224 (314) 425-4380
Calvin E. Ewell Science Teacher	9200 Moon Lake Rd. #84 New Port Richey,FL 33553 (813) 856-4947	Energy Management Center Old Post Road Port Richey, FL 33568 (813) 848-4870
K. Michael Fitzgerald Teacher	950 S. Hazel Court Denver, CO 80219 (303) 935-2717	Hutchinson Elementary 12900 W. Utah Avenue Lakewood, CO 80228 (303) 985-1507
Chris L. Gentry Science Teacher	10955 Grandmason Place Eagle, ID 83616 (208) 286-7838	Boise High School 1010 Washington Boise, ID 83616 (208) 338-3575
Joyce P. Goche Teacher	5521 Colorado, NW Washington, D.C. 20011 (202) 882-8295	West School 14th & Farragut Streets, NW Washington, DC 20011 (202) 576-6226
Judy Wilson Goddard Teacher--Gifted	6015 Cochran Mill Rd. Palmetto, GA 30268 (404) 964-8441	Charles Riley 90 Turner Drive Palmetto, GA 30268 (404) 463-4616
Elaine Hochheiser Science/Math Teacher	1260 Meadowlark Lane Scotch Plains, NJ 07076 (201) 889-4673	Valley View School Valley View Road Watchung, NJ 07060 (201) 755-4422
Ann M. Justus Science Dept. Head/ Science Teacher	1913 E. Coolidge Phoenix AZ 85016 (602) 279-7731	Camelback High School 4612 N. 28th Street Phoenix, AZ 85016 (602) 957-5937
Elizabeth Kellerman Teacher--Gifted	237 Rosemont Avenue Webster Groves,MO 63119 (314) 962-8887	Steger School 701 N. Rockhill Road Rock Hill, MO 63119 (314) 961-5757

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Kristine Kellogg Teacher--Gifted	5016 26th Avenue S. Seattle, WA 98108 (206) 723-6455	Peter Kirk Elementary 1312 Sixth Street Kirkland, WA 98033 (206) 828-3338
Richard W. Knapp Science Teacher	14 Blossom Road Suffern, NY 10901 (914) 357-4310	Kakiat Junior High 465 Viola Road Spring Valley, NY 10977 (914) 356-4100 ext. 444
Elaine Kusulas Teacher	567 Emerson Street Denver, CO 80218 (303) 744-0514	Lasley Elementary 1401 S. Kendall Lakewood, CO 80226 (303) 922-1116
Della McCaughan Science Dept. Head/ Science Teacher	112 West Third Street Biloxi, MS 39530 (601) 432-7748	Biloxi High School Father Ryan Avenue Biloxi, MS 39530 (601) 374-1980
Jack W. Neal Science Teacher	512 W. Lemon Street Lancaster, PA 17603 (717) 392-8260	J. P. McCaskey H.S. 445 N. Reservoir Street Lancaster, PA 17602 (717) 291-6211
Janette C. New Teacher--Gifted	5959 Crane Road Melbourne, FL 32901 (305) 723-6448	Meadowlane Elem. School Minton Road Melbourne, FL 32901 (305) 723-6354
Niles R. Pixley Science Teacher	10005 Pinkney Omaha, NE 68134 (402) 571-2742	North High School 36 and Ames Omaha, NE 68111 (402) 554-6500
Deborah Richau Teacher	2011 Plaza Drive Billings, MT 59102 (406) 259-6962	Poly Drive Elementary 2410 Poly Drive Billings, MT 59102 (406) 656-1120
Lina E. Russ Science Dept. Head/ Science Teacher	7200 Eighth St. NW Washington, D.C. 20012 (202) 723-1303	Alice Deal Junior High Fort Dr.& Nebraska Ave. NW Washington, D.C. 20016 (202) 282-0100
James D. Sproull, Jr. Science Dept. Head/ Science Teacher	416 Blair Road Vienna, VA 22180 (702) 281-3737	McLean High School 1633 Davidson Road McLean, VA 22101 (702) 356-0700

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Dana P. Van Burgh, Jr. Science Dept. Head/ Science Teacher	7805 W. Chalk Creek Casper, WY 82604 (307) 234-7243	Dean Morgan Junior High 1440 S.Elm Casper, WY 82601 (307) 577-4440

1985 HONORS WORKSHOP ROSTER
APPLICATIONS OF SCIENCE WORKSHOP
FLORIDA INSTITUTE OF TECHNOLOGY
MELBOURNE, FL 32901
July 7-20, 1985

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Neal W. Beebe Science Teacher	312 Grant Avenue Endicott, NY 13760 (607) 757-9281	Vestal High School Woodlawn Avenue Vestal, NY 13850 (607) 757-2200
Patricia J. Bonsteel Science Dept. Head	103 W. Melbourne Ave. Melbourne, FL 32901 (305) 723-2553	Stone Middle School 1101 University Blvd. Melbourne, FL 32901 (305) 723-0741
Bill M. Brent Science Dept. Head/ Science Teacher	Route 6, Box 273 Rolla, MO 65401 (314) 364-2453	Rolla Senior High E. 10th Street Rolla, MO 65401 (314) 364-4746
Jeb Carpenter Science Teacher	2003 N. Shannon Ave. Indialantic, FL 32903 (305) 725-2214	Hoover Junior High #1 Hawkhaven Avenue Indialantic, FL 32903 (305) 727-1611
Laryl Lee Delker Science Teacher	756 Paddock Path Moorestown, NJ 08057 (609) 234-0799	Burlington Co. Vocational- Technical School Mount Holly, NJ 08060 (609) 267-4226
T. J. Dieck Science Dept. Head/ Science Teacher	40 W. Basswood Lane Milton, WI 53563 (608) 868-2139	Milton High School High Street Milton, WI 53563 (608) 868-7658
Robert A. Gadinski Science Teacher	Box 642, Rd #1 Ashland, PA 17921 (717) 875-0117	Shenandoah Valley Stadium Road Shenandoah, PA 17976 (717) 462-1957
Florence Kane Teacher Specialist	Route 3, Box 135A Lafayette, AL 36862	Houston Independent School's Outdoor Education Center Route 2, Box 25B Trinity, TX 75862 (409) 594-2541

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
David Lindahl Teacher	23081 Cavanaugh Road El Toro, CA 92630 (714) 830-6511	Saddleback High School 2802 S. Flower Santa Ana, CA 92707 714) 558-5741
Rita D. Livingston Computer Science/ Science Teacher	1301 Manor Drive Casper, WY 82609 (307) 237-8378	Kelly Walsh High School 3500 East 12th Casper, WY 82609 (307) 237-2511
Jane V. Lodas Science Teacher	610 Sunrise Vista Way Santa Barbara, CA 93109 (805) 965-3896	San Marcos High School 4750 Hollister Avenue Santa Barbara, CA 93110 (805- 967-4581
Rhona R. Margolis Teacher	1954 Brook Park Drive Merrick, NY 115676 (516) 546-8892	Lindenhurst Senior High Sch. 300 Charles Street Lindenhurst, NY 11757
Helen Martin Science Teacher	377 Louvaine Drive Buffalo, NY 14223 (716) 877-5881	Kadimah School 250 Athens Blvd. Buffalo, NY 14223 (716) 836-6903
Beverly McMillan Science Teacher	603 SW 7th Marietta, OK 73448 (405) 276-5480	Marietta Middle 510 Gilliam Street Marietta, OK 73448 (405) 276-5480
James L. Mundell Science/Computer/ Math Teacher	10350 W. Warren Drive Lakewood, CO 80227 (303) 986-5922	Dunstan Junior High 1855 S. Wright Lakewood, CO 80226 (303) 985-1545
Kay Neill Science Teacher	410 W. Fifth Concordia, KS 66901 (913) 243-7074	Clifton-Clyde High Clyde, KS 66938 (913) 446-3444
Ronald J. Newland Computer Science/ Science Teacher	733 W. Seventh Street Monticello, IA 52310 (319) 465-5143	Monticello Community School 217 S. Maple Street Monticello, IA 52310 (319) 465-3575
Gary Rebbe Science Coordinator	8425 Lotus Skokie, IL 60077 (312) 966-5569	Melody 412 S. Keller Chicago, IL 60624 (312) 638-1235

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Thomas F. Reed Science Teacher	Box 204 Valatie, NY 12184 (518) 758-1399	Germantown Central School Box 35 Germantown, NY 12526 (518) 537-6281
Donna S. Robinson Teacher	1101 St. Cloud Rapid City, SD 57701 (605) 341-4323	Dakota Junior High 620 Columbus Rapids City, SD 57701 (605) 394-4092
Corine L. Sayler Teacher	1389 North 1700 West Farmington, UT 84025 (801) 451-2226	Davis High School 325 South Main Kaysville, UT 84037 (801) 544-3477
Roseanne Schwartz Teacher	7877 E. Mississippi Ave. #505 Denver, CO 80231 (303) 322-2641	Moore Elementary 846 Corona Denver, CO 80218 (303) 831-7044
Walter F. Soule Physics Teacher	70 Raleigh Tavern Lane North Andover, MA 01845 (617) 683-7851	Winchester Sr. High School 80 Skillings Road Winchester, MA 01890 (617) 721-7020
Gary L. Stringer Science Teacher	110 Patton Drive West Monroe, LA 71291 (318) 396-2337	Ouachita Parish Gifted Prog. 100 Bry Monroe, LA 71201 (318) 388-2711
Richard Strobel Science Teacher	505 Berkeley St. #D155 Satellite Beach, FL 32937 (305) 777-3778	Mt. Lebanon High School 155 Cochran Road Pittsburgh, PA 15228 (412) 344-2050
Arlyn D. Thomas Science Teacher	2411 Carter Place Sioux Falls, SD 57105 (605) 338-2030	Patrick Henry Junior High 2200 S. Fifth Avenue Sioux Falls, SD 57105 (605) 331-7639
Joanne T. Thompson Biology Teacher	3909 Tamarack Boise, ID 83703 (208) 343-1484	Capital High School 8055 Goddard Boise, ID 83704 (208) 322-3875
Esther D. Vigil Teacher	802 York Street San Francisco, CA 94110 (415) 826-19931	Clarendon Elem. School 500 Clarendon San Francisco, CA 94131 (415) 661-2557

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
James L. Zimmerman Fifth Grade Teacher	102 South Dodson Urbana, IL 61801 (217) 344-3778	Thomas Paine 1801 James Cherry Drive Urbana, IL 61801 (217) 384-3602

1986 IOWA STS LEADERSHIP WORKSHOP

Iowa City
June 15-22, 1986

Name Professional Address Position	Home Address Home Telephone	Professional Telephone
Willard Harold Asmus Scienced Ed. Teacher	203 W. 14th Street Cedar Falls, IA 50613 (319) 266-6808	Hoover Intermediate Sch. 630 Hillcrest Road Waterloo, IA 50701 (319) 235-7051
Susan Blunck Teacher/6, 7, & 8	748 - 53 Street Des Moines, IA 50312 (515) 279-3591	St. Augustin 4320 Grand Des Moines, IA 50312 (515) 279-5947
James Canfield Science Teacher/7 & 8	51 West Kirkwood Fairfield, IA 52556 (515) 472-6295	Fairfield Junior High 404 W. Fillmore Fairfield, IA 52556 (515) 472-5019
Barbara Clark Teacher/5	P. O. Box 196 Stuart, OK 74570 (918) 546-2354	Checotah Elementary 205 Owen Avenue Checotah, OK 74426 (918) 473-5832
Deloris (Dee) Ford Teacher/6	2506 Jennings Sioux City, IA 51104 (712) 258-7805	Hunt School 615-20th Street Sioux City, IA 51104 (712) 279-6833
Jim Galles Teacher	803 Ring Street Mapleton, IA 51034 (712) 882-1219	Westwood School Sloan, IA 51055 (712) 428-3303
Royce W. Hammitt	615 3rd Avenue Coralville, IA 52241 (319) 351-7099	Science Education Center The University of Iowa Iowa City, IA 52242
Curt Jeffryes General Science/6	1216 N. Birch Creston, IA 50801 (515) 782-2358	Creston Community Schools Creston, IA 50801 (515) 782-8612
Phyllis A. Johnson Teacher/6	313-34th Street W. Des Moines, IA 50265 (515) 224-4127	Western Hills 600 39th Street W. Des Moines, IA 50265 (515) 225-2802
Larry L. Kimble Teacher/Jr.-Sr. High	R. 4, Box 88 Grant City, MO 64456 (816) 564-2344	Mount Ayr Comm. School 1001 E. Columbus Mount Ayr, IA 50854 (515) 464-2232

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Mary Mascher Teacher/4, 5, 6	1110 DeForest Iowa City, IA 52240 (319) 351-2826	Roosevelt School 611 Greenwood Drive Iowa City, IA 52240 (319) 338-9428
Julie Maske Biology, Chemistry, General Science	R. R. 2, Box 99 West Brnach, IA 52358 (319) 643-7446	West Branch High School West Branch, IA 52358 (319) 643-7216
Morgan Masters Physical Science/8	216 Woodlawn Chariton, IA 50049 (515) 774-4461	Chariton Comm. High School 501 N. Grand Chariton, IA 50049 (515) 774-5066
Richard C. McWilliams Science & Math/H.S.	1707 E. 32nd Court Des Moines, IA 50317 (515) 262-5816	Grandview Park Baptist 1701 E. 33rd Street Des Moines, IA 50317 (515) 265-7579
Charles Piekema Teacher/Middle School	1257 Northridge Road Story City, IA 50248 (515) 733-2804	Roland-Story Middle School 201 Main Street Roland, IA 50236 (515) 388-4348
Ed Rezabek School Teacher/8-12	102 Utah Glidden, IA 51443 (712) 659-3775	Glidden-Ralston Comm. Glidden, IA 51443 (712) 659-2205
Jeanne A. Rogis Science Teacher/ Dept. Head	R. R. 2, #2 DeWitt, IA 52742 (319) 522-2664	Oxford Junction Consol. 313 N. 3rd Oxford Junction, IA 52323 (319) 486-2721
Dale J. Rosene Science Teacher/8 Coordinator/K-6	548 N. Linden Marshall, MI 49068 (616) 781-4844	Marshall MS 100 E. Green Marshall, MI 49068 (616) 781-1251
Perry O. Ross Teacher/4	505 West Clay Mt. Pleasant, IA 52641 (319) 385-4556	Mt. Pleasant Comm. Schools 801 East Henry Mt. Pleasant, IA 52641 (319) 385-2817
Ernest Schiller Biology Teacher	R. R. 2 Donnellson, IA 52625 (319) 835-5601	Central Lee High School R. R. #1 Argyle, IA 52619 (319) 835-5121

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Lee E. Schwerdtfeger Teacher/6	518 W. Garfield Street Centerville, IA 52544 (515) 856-3137	Centerville Comm. Schools West Francis Centerville, IA 52544 (515) 437-4370
Mark Smith Teacher/3 & 4	222 Fairview Iowa City, IA 52240 (319) 337-8379	Penn School North Liberty, IA 52317 (319) 626-2311
Donna C. Terry Teacher/4	R. R. 1 Numa, IA 52575 (515) 898-7391	Wayne Community Schools 607 S. West Corydon, IA 50060 (515) 872-1034

1986 UTAH STS WORKSHOP
Iowa City, IA
July 6-12, 1986

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Bill Barnes Chairman/Science Dept.	1678 Cherry Lane Layton, UT 84041 (801) 544-8544	North Layton Junior High 1100 West 2000 North Layton, UT 84041 (801) 774-7451
Dwight Brown Biology	792 East 550 North Bountiful, UT 84010 (801) 292-5336	Bountiful High 695 S. Orchard Drive Bountiful, UT 84010 (801) 299-2055
Dale Christopherson Chairman/Science Dept.	4691 South 5900 West Hooper, UT 84315 (801) 773-0573	North Ogden Junior High 575 East 2900 North Ogden, UT 84404 (801) 782-5771
Orwin Draney Chairman/Science Dept.	249 North 800 East Kaysville, UT 84037 (801) 544-8278	Mound Fort Middle 1400 Mound Fort Drive Ogden, UT 84404 (801) 399-3456
Kathryn Grandison Science	3753 South 2100 West Roy, UT 84067 (801) 731-4269	Roy Junior High 2100 West Roy, UT 84067 (801) 825-1605
Robert L. Hillier Teacher	2135 West 1070 North Layton, UT 84067 (801) 544-3316	Sunset Junior High 1610 North 250 West Sunset, UT 84041 (801) 774-7440
Greg Lewis Chairman/Science Dept.	1695 East 1250 South Ogden, UT 84404 (801) 782-6189	Central Middle School 781 75th Ogden, UT 84401 (801) 399-3456
Virginia Ord Teacher	980 East Arlington Way Bountiful, UT 84010 (801) 295-5106	Millcreek Junior High 245 East 1000 South Bountiful, UT 84010
Harvey Price Science/Math	741 West 1300 South Woods Cross, UT 84087 (801) 295-7151	Farmington Junior High Farmington, UT

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Ken Prince Earth Science	5850 South 1376 East Ogden, UT 84405 (801) 479-8866	South Ogden Junior High 4300 S. Madison Ogden, UT 84403 (801) 479-9040
Al Stokes Teacher	4520 W. 1975 North Ogden, UT 84404 (801) 731-1904	South Ogden Junior High 4300 Madison Avenue Ogden, UT 84403 (801) 399-3351
Brent Thurgood Chairman/Science Dept.	6300 West 6000 South Hooper, UT 84315 (801) 825-1742	Wahlquist Junior High 1033 North 1200 West Ogden, UT 84404 (801) 399-3351

1986 WYOMING SUMMER LEADERSHIP (ELEMENTARY)
East Douglas
June 7 to June 11

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Barbara J. Broderdorp	611 S. 11th Douglas, WY 82633 (307) 358-2799	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
Robert J. Bushong	538 S. 4th Douglas, WY 82633 (307) 358-5395	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
Sonia Cottrell	1025 Vandera Douglas, WY 82633 (307) 358-4412	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
Vanna Krank (McKay)	520 S. 5th Douglas, WY 82633 Unlisted	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
Ron Kribbs	14 Mountain View Rd. Douglas, WY 82633 (307) 358-4811	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
David Kursisto	1936 Yucca Drive Douglas, WY 82633 No Phone	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
Robert Pesicka Principal	627 Grand Street Douglas, WY 82633 (307) 358-5727	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502
Elizabeth Robertson	Box 314 Douglas, WY 82633 (307) 358-3308	East Douglas Elementary E. Hamilton Avenue Douglas, WY 82633 (307) 358-3502

1986 FLORIDA LEADERSHIP WORKSHOP (ELEMENTARY)
Tampa and Fort Lauderdale
June 25 - June 30, 1986

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Debra K. Allen Gifted Science/6	4601 N. Cork Road Plant City, FL 33566 (813) 754-3489	Burney-Simmons 901 E. Evers Tampa, FL 33566 (813) 752-3496
Katherine K. Bartlett Science & Math	15305 Spruson Street Odessa, FL 33556 (813) 920-5611	Seminole School 6201 N. Central Avenue Tampa, FL 33604 (813) 231-9302
Marilyn Blackmer Gifted Science	15504 Woodfair Place Tampa, FL 33613 (813) 961-1407	Lake Magdalene School 2002 Pine Lake Drive Tampa, FL 33612 (813) 932-0275
Mary Rita Brady Teacher	6741 Miramar Pkwy. Miramar, FL 33023 (305) 966-7201	
Margaret (Bonnie) Brock Teacher	5115 SW 92nd Avenue Cooper City, FL 33328 (305) 434-7376	A. C. Perry Elementary 6850 SW 34th Street Miramar, FL 33024 (305) 981-5790
Sandra Gout Teacher/Gifted	4216 Estrella Tampa, FL 33629 (813) 872-8944	Yates Elementary 3105 Kingsway Brandon, FL 33511 (813) 689-3975
Beatrice R. Green Teacher/5	1016 Neptune Drive Ruskin, FL 33570 (813) 645-1691	Buckhorn Elementary 1717 Miller Road Valrico, FL 33594 (813) 685-3320
Judy Holtz Asst. Principal	6988 NW 29 Way Ft. Lauderdale, FL 33309 (305) 972-0424	Coral Springs Elementary NW 110 Avenue Coral Springs, FL 33065 (305) 752-3850
Barbara Morningstar Teacher	4530 N.E. 14th Terr. Pompano Beach, FL 33064 (305) 781-4356	Norcrest Elementary 3951 N.E. 16th Avenue Pompano Beach, FL 33064 (305) 941-3920

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Rheta Norman Teacher/5	2229 NW 62 Terrace Margate, FL 33063 (305) 979-2371	Margate Elementary 6300 18th Street Margate, FL 33063 (305) 972-6421
Charlotte Pine Teacher/Gifted	1760 SW 67 Terrace Plantation, FL 33317 (305) 791-7900	Nob Hill Elementary 2100 NW 104 Avenue Sunrise, FL 33322
Lucinda Romano Teacher/Gifted, Science	3217 Elk Court Brandon, FL 33511 (813) 6811-6113	Progress Village 8113 Zinnia Drive Tampa, FL 33694 (813) 677-6874
Garie H. Rose Teacher	1839 Middle River Dr. #104 Ft. Lauderdale, FL 33305 (305) 563-2749	Pompano Beach Elementary 700 N.E. 13th Avenue Pompano Beach, FL 33060 (305) 942-7100
Sandra Schlichting Elementary Science Consultant	10710 Dixon Drive Riverview, FL 33569 (813) 677-6727	Idea Factory, Inc. Riverview, FL 33569 (813) 677-6727
Ellyn B. Smith Teacher/Gifted	4018 Orangefield Place Valrico, FL 33594 (813) 681-1899	Kingswood Elementary 3102 S. Kings Avenue Brandon, FL 33594 (813) 689-9131
Peggy A. Snuggs Gifted Science	17014 Aspen Meadow Dr. Lutz, FL 33549 (813) 949-1585	J. W. Lockhart School 1714 E. Lake Avenue Tampa, FL 33610 (813) 248-1530
Frank A. Stone Teacher/Science	622 N.E. 14th Avenue Ft. Lauderdale, FL 33304 (305) 763-8328	Floramada Elementary 5152 NE 14 Way Ft. Lauderdale, FL 33304 (305) 492-8880
Patricia Yarnot Teacher/Gifted Science	14106 Bardsdale Lane Tampa, FL 33625 (813) 961-8297	Claywell School 4500 Northdale Blvd. Tampa, FL 33624 (813) 963-2166
Dorothy H. Zielinski Teacher/Math, Science Grade 5	804 Scenic Hgts. Drive Brandon, FL 33511 (813) 681-3320	Kingswood Elementary 3102 S. Kings Avenue Brandon, FL 33511 (813) 689-9131

1986 STORM LAKE CHAUTAUQUA ROSTER
September 19-20 and February 27-28

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Larry Beeson Grades 9/10/11/12	McCook M. Est. #11 Jefferson, IA 51104 (605) 232-4618	North High School 4200 Cheyenne Blvd. Sioux City, IA 51104
Judy Bierman Grade 4	901 Harris Cherokee, IA 51012 (712) 225-5552	Webster Elementary 400 North Roosevelt Cherokee, IA 51012 (712) 225-2786
Karen Bleeker Grade 5	1505 Elm Court Sheldon, IA 51201 (712) 324-3606	Sheldon Christian 1425 E. 9th Street Sheldon, IA 51201 (712) 324-2429
Beth Bretthauer Grades 3/4	Box 62 Renwick, IA 50577 (515) 824-3786	Boone Valley 301 Montgomery Renwick, IA 50577 (515) 824-3786
Hugo C. Denker Grade 8	505 N. Main Denison, IA 51442 (712) 263-4394	Denison Middle School 1515 E. Broadway Denison, IA 51442 (712)263-9393
Steve DeRocher Grades 6/7/8	601 3rd Street Cushing, IA 51018 (712) 384-2462	Eastwood Community Sch. Cushing, IA 51018 (712) 384-2568
Larry E. Eckard Grade 8	308 2nd Avenue Royal, IA 51357 (712) 933-2472	Clay Central Church Street Royal, IA 51357 (712) 933-2241
Robert Fertig Grades 6/7/8	Box 69 Moville, IA 51039 (712) 873-3911	Woodobury Central Climbing Hill Moville, IA 51039
Linda Fiske Grade 5	R. R. 1 Correctionville, IA (712) 375-5206	Eastwood School Cushing Center Cushing, IA (712) 384-2568
Pat Fredrickson Grade 4	R. R. Larrabee, IA (712) 437-2493	Webster Elementary 400 North Roosevelt Cherokee, IA 51012 (712) 225-2786

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Marjorie Frisbie Grade 6	Box 224A, R.R.4 Cherokee, IA 51012 (712) 225-4107	Roosevelt Middle School 9929 N. Roosevelt Cherokee, IA 51012 (712) 225-2425
Randy W. Graff Grades 8/9	1111 Fargo Street Spirit Lake, IA 51360 (712) 336-4308	Spirit Lake 2000 Hill Avenue Spirit Lake, IA 51360 (712) 336-1370
Lisa Holtze Grade 5	3830 Pierce Street Sioux City, IA 51106 (712) 258-2117	Washington School 2550 S. Martha Street Sioux City, IA 51106
Ann Johnke Grades 9/10/11/12	Box 9 Royal, IA 51357 (712) 933-2227	Clay Central Church Street Royal, IA 51357 (712) 933-2242
Mike Kobliska Grades 3/4	Box 84 Renwick, IA 50577 (515) 824-3501	Boone Valley 301 Montgomery Street Renwick, IA 50577 (515) 824-3489
Eric Larsen Grades 8/9/10-12	Box 275 Anthon, IA 51004 (712) 373-5605	Anthon - Oto School Anthon, IA 51004 (712) 373-5246
Harley R. Lehman, Jr. Grade 8	R.R. 2, Box 12 Webster City, IA 50595 (515) 832-5645	Webster City Junior H.S. 740 Bank Street Webster City, IA 50595 (515) 832-2648
Harlan Meints Grades 7/8/9	Box 12 Ute, IA 51060 (712) 855-2692	Charter Oak-UTE Charter Oak, IA 51060 (712) 885-2692
Nancy Parrot Grades 5/6	105 N. 4th Washta, IA 51037 (712) 447-6109	Meriden-Cleghorn Comm.Sch. 405 Eagle Meriden, IA 51037 (712) 443-8378
Sheree Pandil Grade 6	2947 19th Avenue N. Fort Dodge, IA 50501 (515) 573-7615	Fair Oaks Middle School 416 S. 10th Fort Dodge, IA 50501 (515) 576-3138
Becky Phipps Grade 5	R.R. 3 Cherokee, IA 51012 (712) 225-4705	Roosevelt Elementary 929 N. Roosevelt Cherokee, IA 51012 (712) 225-2425

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Edna M. Tonner Grade 4	Box 15 Primghar, IA 51248 (712) 757-3106	Sanborn Community School Main Street Sanborn, IA 51248 (712) 729-3281
Harold Troyer Grades 5/6	R.R. 2 Manson, IA 50541 (712) 469-2606	Gilmore City-Bradgate Sch. Gilmore City, IA 50541 (515) 373-6092

1986 SPRINGBROOK CHAUTAUQUA ROSTER
October 31-November 1 and May 2-3

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Lynn Altemeier Grade 7	304 34th Court W. Des Moines, IA 50265 (515) 225-0035	Indian Hills Junior H.S. 9401 Indian Hills Drive Des Moines, IA 50265 (515) 223-5705
Charles Barker Grades 9-12	Avoca, IA 51521 (712) 343-6301	Walnut High School Walnut, IA 51521
Sandy Booker Grades 4-6	Box 207 Riverton, IA 51650 (712) 387-3841	Farragut Community School Farragut, IA 51650 (712) 385-8131
Janelle Bryte Grades 7/8/9-12	R.R. 2 Northboro, IA 51650 (712) 534-2265	Farragut Community School Farragut, IA 51650 (712) 385-8131
Gary N. Cameron Grade 9	5919 Greendale Pl. #202 Johnston, IA 50131 (515) 270-0247	Hoover High School 4800 Aurora Avenue Des Moines, IA 50310 (515) 276-8584
Janet Comfort Grade 5	P.O. Box 87 Blencoe, IA 51523 (712) 452-2786	Perry Community School Perry, IA 50220
Cheryl Corey K-12	Box 494 Walnut, IA 51577 (712) 784-3676	Walnut High School Walnut, IA 51577 Walnut,IA 51577 (712) 784-3615
Kay Dreyer Grades 7/8	Box 233 Farragut, IA 51650 (712) 385-8131	Farragut Community School Farragut, IA 51650 (712) 385-8131
J.Alan Fink Grade 4	701 N. 7th Street Oskaloosa, IA 52577 (515) 673-0091	Lincoln Elementary 911 B Avenue West (515) 673-7462
Veda F. Flint Grade 4	309 Ridgeway Drive Glenwood, IA 51534 (712) 527-9167	Northeast Elementary 8 N. Linn Glenwood, IA 51534 (712) 527-4875
Rodney D. Hacker Grade 6	R. R. 3 Oskaloosa, IA 52577 (515) 673-8248	Lincoln Elementary 911 B Avenue West Oskaloosa, IA 51577 (515) 673-7462

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Keitha J. Herington Grade 5	R.R. 3 Oskaloosa, IA 52577 (515) 673-5339	Garfield Elementary 227 S. Main Street Oskaloosa, IA 52577 (515) 673-3052
Lynnette A. Keating Grade 6	1013 Manor Dr., Apt 8 Creston, IA (515) 7882-9257	East Union Comm. Schools Lorimor Building Creston, IA
Vicki LePorte Grade 9	R.R. 1 Shenandoah, IA 51601 (712) 246-5121	Shenandoah High School 1000 Mustang Drive Shenandoah, IA 51601 (712) 246-4727
Roger Mathias Grade 8	1011 Chestnut Street Atlantic, IA 50022 (712) 243-3623	Schuler Junior H.S. 1100 Linn Street Atlantic, IA 50022
Cheryl K. Peck Grades 7-12	R.R. 2 Glidden, IA 51443 (712) 659-2205	Glidden-Ralston Comm. Sch. Idaho Street Glidden, IA 51443 (712) 659-2289
Ronald W. Pethoud Grade 6	1602 21st Harlan, IA 51537 (712) 755-2533	Harlan Middle School 7th & Baldwin Harlan, IA 51537 (712) 755-3196
Patricia A. Semprini Grades 7-9	406 lst St., SW Clarion, IA 50452 (515) 532-2236	Cal Community Schools Box 459 Latimer, IA 50452 (515) 579-6086
Andrew C. Stone Grades 4/5/6	Box 198 Newton, IA 50208 (515) 792-7880	Woodrow Wilson Elementary 801 S. 8th Avenue W. Newton, IA 50208 (515) 792-7311
Pamela Stone Grade 4	Box 198, RR 4 Newton, IA 50208 (515) 792-7880	Lincoln Elementary 701 S. 4th Avenue E. Newton, IA 50208 (515) 792-4494
Judith L. Wachter Grades 5/6	R.R. 2, Box 134 Creston, IA 50831 (515) 782-7958	East Union Community Sch. Arispe, IA 50831 (515) 346-2231
Fred E. Worrell Grade 5	Box 7 Kiron, IA 51442 (712) 675-4528	Denison Community School Denison, IA 51442 (712) 263-3104

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Donna Wynn Grade 4	2111 Douglas Sioux City, IA 51104 (712) 252-3117	Hunt Elementary 615 20th Street Sioux City, IA 51104 (712) 279-6833
Craig A. Zoellner Grades 9-12	R.R. 1 Nora Springs, IA 50401 (515) 749-2457	Newman High School 2445 19th Street SW Mason City, IA 50401 (515) 423-6939

1986 DECORAH CHAUTAUQUA ROSTER
October 3-4 and January 30-31

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Cheryl Donlon		St. Benedict School Rural Avenue Decorah, IA 52101
Carolyn England Grade 8	Box 31 Ft. Atkinson, IA 52150 (319) 534-7191	Turkey Valley Jackson Junction, IA 52150 (319) 776-7496
Daniel Reed England Grade 5	Box 31 Ft. Atkinson, IA 52150 (319) 562-3617	St. Wenceslaus Elementary Spillville, IA 52168 (319) 562-3617
Barbara Glessner Grade 7	1946 W. 7th Street Waterloo, IA 50702 (319) 234-8145	West Intermediate School W. 5th Street Waterloo, IA 50702 (319) 233-8497
Lynda Hubbard		St. Benedict School Rural Avenue Decorah, IA 52101
Shirley Kellogg Grades 7/8/9-12	1114 Acre Guttenberg, IA 52052 (319) 252-1114	Guttenberg Community 131 River Park Drive Guttenberg, IA 52052 (319) 252-2341
Paula Jewell		St. Benedict School Rural Avenue Decorah, IA 52101
Amy Kust		Torah Academy 2800 Joppa Avenue S. St. Louis Park, MN 55416
Dave Kust		John Kline Elementary Decorah, IA 52101
Myrna M. Moore Grade 6	Hillcrest Addition Fredericksburg, IA 52135 (319) 237-6137	Larrabee Elementary Clermont, IA 52135 (319) 423-5273
James Ostby Grade 7	2303 Franklin Street Cedar Falls, IA 50701 (319) 266-6340	Edison Intermediate Sch. 800 Rock Island Avenue Waterloo, IA 50701 (319) 234-2855
Meg Storkamp Grades 6/8		St. Benedict School Rural Avenue Decorah, IA 52101 (319) 382-4668

1986 BETTENDORF CHAUTAUQUA ROSTER
November 7-8 and March 13-14

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Steven Andrusyk Grades 4/5/6	2415 Tremont Avenue Davenport, IA 52803 (319) 324-8223	Buffalo Elementary School 329 Dodge Street Buffalo, IA 52728 (319) 381-2232
Steven W. Bateman Grade 8	3005 Olde Country Lane Dubuque, IA 52001 (319) 556-7190	Jones Junior H.S. 1090 Alta Vista Street Dubuque, IA 52001 (319) 557-9511
William C. Beck Grade 6	1719 1/2 12th Avenue Moline, IL 61265 (309) 762-3213	Horace Mann Elementary Sch. Rt 1, Box 115 Moline, IL 61265 (309) 399-3139
Kenneth Brady Grade 9	203 Broadway Lost Nation, IA 52242 (319) 678-2311	Maquoketa Junior H.S. 200 E. Locust Maquoketa IA 52060 (319) 652-4956
Sandra S. Brady Grade 6	203 Broadway Lost Nation, IA 52242 (319) 678-2311	Lost Nation Community Sch. 100 Winter Street Lost Nation, IA 52242 (319) 678-2142
David J. Brune Grades 5/6/7/8	615 N. 5th Street West Point, IA 52626 (319) 837-6160	Harmony Middle School Farmington, IA 52626 (319) 878-3814
David L. Burgus Grade 6	1400 O'Hagen Street Dubuque, IA 52001 (319) 583-7849	Irving Elementary School 2520 Pennyslvania Avenue (319) 557-9780
Sharon E. Cinotto Grades 4/5/6	219 Timber Valley Blue Grass, IA 52773 (319) 381-2475	Walcott Elementary School 545 East James Walcott, IA 52773 (319) 284-6253
Charlotte Densford Grade 5	2412 36th Avenue Rock Island, IL 61256 (309) 788-7841	Hampton Elementary School 206 5th Street Hampton, IL 61201
Rae Ann Dickinson Grades 3/4	816 River Street Sabula, IA 52070 (319) 687-2810	East Central Schools Sabula, IA 52070 (319) 687-2427

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Glenn Drowns Grades 8/11/12	R.R. 1, Box 37 Calamus, IA 52729 (319) 843-2368	Calamus-Wheatland H.S. Wheatland, IA 52777 (319) 374-1292
Sheila Engel Grade 4	2615 W. 36th Street Davenport, IA 52804 (319) 391-2916	Holy Family School 1926 Marquette Street Davenport, IA 52804 (319) 324-3205
James W. Engler Grade 6.	2914 Allen Street Muscatine, IA 52761 (319) 263-7632	Central Middle School Cedar Street Muscatine, IA 52761 (319) 263-7784
Kathy Erickson Grades 5/6	311 East 10th Street Davenport, IL 61201 (319) 322-0432	Lincoln Elementary Sch. 21st & 6th Avenue Rock Island, IL 61201 (309) 786-4161
Thomas B. Ervin Grades 8/9	R.R. 1, Box 472 LeClaire,IA 52753 (319) 289-3139	Wood Junior H.S. 5701 North Division Davenport, IA 52753 (319) 391-6350
Larry G. Flathman Grades 6/8	840 E. Iowa St. #3-D Eldridge, IA 52722 (319) 285-7021	Bettendorf Middle School 2030 Middle Road Bettendorf, IA 52722 (319) 359-3686
Linda M. Free Grade 4	2129 13th Street Moline, IA 52722 (309) 762-0110	Neil Armstrong School 800 23rd Street Bettendorf, IA 52722 (319) 359-8275
Marlene Gaston Grades 5/6	Rt 2, Box 241 Wellman, IA 52247 (319) 646-2440	Kalona Elementary School Kalona, IA 52247 (319) 656-2243
Wilma M. Graden Grades 6/7	1544 23rd Street Bettendorf, IA 52722 (319) 355-2431	Middle School 2030 Middle Road Bettendorf, IA 52722 (319) 359-3686
Helena K. Hallowell Grade 5	R.R. 2, Box 161A Burlington, IA 52601 (319) 752-4027	Washington Elementary Sch. 1910 Agency Burlington, IA 52601 (319) 753-5092

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Kay Hoyt Grades 4/5/6	3 Cherokee Court Eldridge, IA 52748 (319) 285-8268	Jackson Elementary School 1307 Wisconsin Avenue Davenport, IA 52804 (319) 322-1787
Phillip D. Hund Grade 8	#9 W. Colorado Ct. Davenport, IA 52804 (319) 391-4185	Williams Junior H.S. 3040 N. Division Davenport, IA 52804 (319) 391-6550
Penny Jo Jacobi Grade 7	R. R. 1 Wheatland, IA 52777 (319) 374-1266	Calamus/Wheatland Com. Sch. Wheatland, IA 52777 (319) 374-1292
Kathleen A. Jager Grade 1	1003 W. Locust St. #3 Davenport, IA 52804 (319) 324-6897	Holy Family School 1926 Marquette Street Davenport, IA 52804 (319) 324-3205
Norma Jones Grade 5	1001 Hillside Drive Bettendorf, IA 52722 (319) 359-5952	Mark Twin School 1620 Lincoln Road Bettendorf, IA 52722 (319) 359-8263
Helen E. Keppler Grade 5	1265 Grandview Avenue Dubuque, IA 52001 (319) 582-2372	Bryant 1280 Rush Street Dubuque, IA 52001 (319) 557-9631
David Langtimm Grade 4/6	3220 Oxford Drive Bettendorf, IA 52753 (319) 355-0992	Cody Elementary School LeClaire, IA 52753 (319) 289-5132
Barbara Maas Grade 7	105 Park Avenue Street Eldridge, IA 52806 (319) 285-9465	Wood Junior H.S. 5701 N. Division Street (319) 391-6350
Marcia Manner Grade 5	511 6th Street W. Andalusia, IL 6123 ++ (309) 798-2510	Reynolds Elementary School Box 6 Reynolds, IL 61279 (309) 372-8822
Nancy McGrath Grade 7	3692 2nd Street Ct. E. Moline, IL 61244 (309) 755-4508	Wood Junior H.S. 5701 N. Division Davenport, IA 52806 (319) 391-6350
Joan I. McShane Grades 4/5/6	1121 W. 15th Street Davenport, IA 52804 (319) 323-5886	Jefferson Elementary 1027 Marquette Davenport, IA 52804 (319) 322-3557

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Joel Moeller Grades 4/5/6	3164 Sunburst Drive Bettendorf, IA 52722 (319) 322-6152	Riverdale/Pleasant View Elementary School Highway #67 Pleasant Valley, IA 52722 (319) 355-5347
Carol Montz Grade 4	R.R. 1 Webster, IA 52356 (319) 667-5675	Mid-Prairie/Wellman Elem. Wellman, IA 52356 (319) 646-2984
Mary R. Mueller Grade 1	1323 W. High Street Davenport, IA 52804 (319) 326-5223	Holy Family School 1926 Marquette Street Davenport, IA 52804 (319) 324-3205
Ranae R. Rickels Grades 9-12	13677 Crosby Road Morrison, IA 61270 (815) 772-4570	Clinton High School 8th Avenue & 9th Street Clinton, IA 52732 (319) 243-7540
Irene E. Rockhold Grade 5	1115 155th Avenue W. Milan, IL 61264 (309) 787-4548	Reynolds Elementary Sch. Box 6 Reynolds, IL 61279 (309) 372-8822
David P. Schmidt Grades 9-12	3700 11th Avenue Rock Island, IL 61201 (309) 788-1373	United Township H.S. 42nd Ave. & Archer Dr. East Moline, IL 61244 (309) 752-1675
Ronald M. Schneider Grade 9	2235 N. Thornwood Davenport, IA 52804 (319) 391-0922	Williams Junior H.S. 3040 Division Davenport, IA 52804 (319) 391-6350
Joel Schroeder Grades 9-12	Box 85, R.R. 1 Calamus, IA 52729 (319) 246-2778	Calamus-Wheatland H.S. Wheatland, IA 52777 (319) 374-1292
Carley Smith Grade 4	820 W. 11th Street Milan, IL 61264 (309) 787-1649	Hampton Elementary 206 5th Street Hampton, IL 61256 (309) 755-0693
Chris Soldat Grade 7-9	Rt. 3, Box 196 Iowa City, IA 52240 (319) 683-2817	Mid-Prairie Junior H.S. Kalona, IA 52247 (319) 656-2241
Mary Thiel Grades 5/6	Delmar, IA 52037	Delwood Community Schools Delmar, IA 52037

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Alberta Thien Grades 4/5	R.R. 2 Tipton, IA 52761 (319) 886-2866	Mulberry School 3211 Mulberry Street Muscatine,IA 52761 (319) 263-8143
Helen Van Vooren Grade 5	223 28th Avenue Moline, IL 61265 (309) 797-4393	Horace Mann Elementary Sch. Route 1, Box 115 Moline, IL 61265 (309) 799-3139
Gabriel A. Verstraete Grades 9-12	513 23rd Avenue East Moline, IL 61244 (309) 755-8812	United Township H.S. Archer Drive & 42nd Ave. East Moline, IL 61244 (309) 752-1675
Karla K. Weidler Grades 6/7	1705 Devitt Muscatine, IA 52761 (319) 263-3650	Central Middle School 901 Cedar Street Muscatine, IA 52761 (319) 263-7784
LaRee Ann Wells Grade 6	Box 26 Reynolds, IL 61279 (309) 372-4261	Reynolds Elementary Sch. Box 6 Reynolds, IL 61279 (309) 372-8822
Nancy Wright Grades 5/6	1510 Douglas Dubuque, IA 52001 (319) 588-3170	Lincoln Elementary School 1101 West 5th Dubuque, IA 52001

1986 UTAH STS WORKSHOP
Provo
July 14 - July 19

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Alice W. Clemans	154 E. Center Street P.O. Box 131 Laketown, UT 84038 (801) 946-8631	(801) 793-2135
William A. Crosby	150 North 610 West #61 Hurricane, UT 84737 (801) 635-2679	(801) 635-4608 (801) 635-2931
Robert C. Cuff	675 West 3rd Avenue Richfield, UT 84701	
Clark H. Day	955 South 800 East Springville, UT 84663 (801) 489-4632	
Lynda L. Giese	691 East 1500 South Vernal, UT 84078 (801) 789-6809	
Leslie D. Good	110 East lst South Mayfield, UT 84643 (801) 528-3250	(801) 835-4618
William J. Hunter, Jr.	828 West River Glen Dr. Murray, UT 84123 (801) 266-7060	
Richard R. Peterson	Box 326 Manilla, UT 84046 (801) 784-3512	(801) 784-3174
Douglas Pusey	532 East 700 South Orem, UT 84058 (801) 225-0199	(801) 224-8122
Collin E. Rose	P.O. Box 78 Annabella, UT 84711 (801) 896-8020	(801) 527-4431
Steven D. Rowley	541 West 600 North Richfield, UT 84701 (801) 896-6658	(801) 896-8247

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Judy Wagner	1010 South 4th East #33 Springville, UT 84663 (801) 489-3721	(801) 489-9477
Thomas J. Willis, III	Rt 1, Box 58G Genola, UT 84655 (801) 754-3010	(801) 465-9231
Royle V. Wood	369 South 460 West 100-8 Hurricane, UT 84737 (801) 635-2689	(801) 635-4608
Jay Woodard	432 North 100 East Nephi, UT 84648 (801) 623-1748	

1986 UTAH STS WORKSHOP
Ogden
July 14 - July 19

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Lyle E. Allen	1069 South 8700 East Huntsville, UT 84317 (801) 745-6636	(801) 745-3713
Albert L. Bouwhuis	4065 Porter Ogden, UT 84403 (801) 394-5636	(801) 479-6140
Robert W. Cefalo	621 South 200 West Brigham City, UT 84302 (801) 723-6105	(801) 723-8533
Michelle L. Cunningham	1175 Canyon Rd. #39 Ogden, UT 84404 (801) 394-3531	
Clair T. Hiatt	1211 Valhalla Drive Clearfield, UT 84015 (801) 773-3636	(801) 731-4255
Jane B. Holmes	3463 Viking Drive Nordic Valley Liberty, UT 84310 (801) 745-3908	(801) 399-3456 ext. 235
Duane S. Isaac	42 South 750 East Bountiful, UT 84010 (801) 295-9248	
John E. James	1934 Redondo Avenue Salt Lake City, UT 84108 (801) 486-9426	(801) 322-1471
Eldon C. Jensen	4588 South 3650 West Roy, UT 84067 (801) 731-7009	
Glen H. Lambson	961 N. Main Farmington, UT 84025 (801) 451-2487	

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
James H. Larsen	P.O. Box 42 (Lot 30, Fairview Heights) Fairview, UT 84629 (801) 427-9223	
Larry Leatham	205 East 5200 South Ogden, UT 84405 (801) 479-3716	(801) 399-3456 ext. 250
Gary R. Lee	567 28th Street Ogden, UT 84403 (801) 392-3373	
Lyle R. London	4945 South 2875 West Roy, UT 84067 (801) 825-8813	
Perry J. Madson	2212 E. Antelope Drive Layton, UT 84041 (801) 546-3489	(801) 782-5771
Gary D.Morrill	R.F.D. Box 227-B Coalville, UT 84017 (801) 336-5500	(801) 336-5656
Kathleen P. Ochsenbein	5948 South 2000 West Roy, UT 84067 (801) 825-4924	(801) 825-1605
Blaine C. Phillips	5275 South 200 West Ogden, UT 84405 (801) 479-8688	(801) 782-0690
Alan N. Porter	1225 North 200 West Bountiful, UT 84010 (801) 295-3271	
Larry E. Tuttle	1044 East 3200 North N. Ogden, UT 84404 (801) 782-4809	(801) 399-3456 ext. 235
Anthony B. Waddell	2730 Jackson Avenue Ogden, UT 84403 (801) 393-5736	(801) 399-3551
Wilford Wilson	3008 West 1975 North Ogden, UT 84404 (801) 731-4795	(801) 479-7920

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Farrell K. Yeates	635 East 100 North Centerville, UT 84014 (801) 295-7017)	

1986 EAST DOUGLAS ELEMENTARY WORKSHOP
August 15 to August 20

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Bonnie Anderson Grade 5	Box 1212 Lusk, WY 82225 (307) 334-2954	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Dan Anderson Grade 5	Box 1073 Lusk, WY 82225 (307) 334-3297	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Edie Brewer Grade 4	4712 E. 13th Street Cheyenne, WY 82001 (307) 638-6842	Churchill Elementary 510 W. 29th Street Cheyenne, WY 82001 (307) 635-5211
Carlyle Buechler Rural School K-8	Star Rt. 1, Box 151A Lusk, WY 82225 (307) 334-3446	Zerbst School Star Rt. 1, Box 151A Lusk, WY 82225 (307) 334-3446
Shirley Debus K-1 Aide	Box 1071 Lusk, WY 82225 (307) 334-2861	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Stephen Fenton Principal	Box 73 Lusk, WY 82225 (307) 334-3036	Lusk Elem. & Middle Sch. Niobrara Co. Sch. Dist. 1 Lusk, WY 82225 (307) 334-2224
Jane Fornstrom Grade 4	917 E. 10th Pine Bluffs, WY 82082 (307) 245-3618	Pine Bluffs Elementary Pine Bluffs, WY 82082 (307) 245-3634
Judy Hamaker Grade 1	Box 211 Lusk, WY 82225 (307) 334-3734	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Joyce Hammer Kindergarten	Box 286 Lusk, WY 82225 (307) 334-3031	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Marylou Huitt K-8 Substitute	Lusk, WY 82225 (307) 334-3561	

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Norma Hunt Grade 2	1308 Green Acres Court Cheyenne, WY 82001 (307) 635-8535	Lebhart Elementary 807 Coolidge Street Cheyenne, WY 82001 (307) 634-2157
Yvonne Jensen Special Ed. Aide	Box 672 Lusk, WY 82225 (307) 334-3898	Lusk Middle School Lusk, WY 82225 (307) 334-2224
Rebecca Kaltenheuser Grade 1	Box 1047 Lusk, WY 82225 (307) 334-3670	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Jan Kindle K-8 Library Aide	Box 71 Lusk, WY 82225 (307 334-3173	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Laura Klenk Rural School, K-8	Box 143 Lance Creek, WY 82222 (307) 334-3571	Lusk Elem. & Middle School Lusk, WY 82225 (307) 334-2224
Bev Miller Grade 4	Star Rt. Box 333 Lance Creek, WY 82222 (307) 334-3498	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Earl Richardson Grades 5 & 6 Science/Reading	708 Arapaho Cheyenne, WY 82009 (307) 632-0225	Bain Elementary 903 Adams Cheyenne, WY 82001 (307) 632-6424
Linda Robinson Grade 6	4408 Pine Cove Road Billings, MT 59106 (406) 656-1871	Central Heights School 120 Lexington Avenue Billings, MT 59102 (406) 656-4240
Anita Troudt Grade 2	Box 1242 Lusk, WY 82225 (307) 334-2307	Lusk Elementary Lusk, WY 82225 (307) 334-2224
Gary Troudt Social Studies, PE	Box 1242 Lusk, WY 82225 (307) 334-2307	Lusk Middle School Lusk, WY 82225 (307) 334-2224
Joe Tully Grades 6, 7, 8	Box 903 Lusk, WY 82225 (307) 334-3528	Lusk Middle School Lusk, WY 82225 (307) 334-2224
Wava Tully Grade 2	Box 903 Lusk, WY 82225 (307) 334-3528	Lusk Elementary School Lusk, WY 82225 (307) 334-2224

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
May Wallace Grade 3	328 Main Street Burns, WY 82053 (307) 547-2251	Hillsdale Elementary Nash Street Hillsdale, WY 82060 (307) 547-3468
Roger Will Grade 4	2780 Olive Drive Cheyenne, WY 82001 (307) 634-6230	Albin Elementary Albin, WY 82050 (307) 246-3362
Shirley Wulf Elementary Monitor of Basic Skills	P.O. Box 694 Pine Bluffs, WY 82082 (307) 245-3855	School Admin. Office 311 8th Street Pine Bluffs, WY 82082 (307) 245-3738

1986 WYOMING ELEMENTARY WORKSHOP
Laramie
August 4 to 9

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Mary A. Boe Teacher/1	309 Big Horn Moorcroft, WY 82721 (307) 756-9285	Moorcroft Elementary 101 S. Bell Fourche Ave. Moorcroft, WY 82721 (307) 756-3373
Elizabeth V. Bujak Teacher/5, Sci. Curr. Chair.	Box 373 Glenrock, WY 82637 (307) 436-9522	Box 1240 Glenrock, WY 82637 (307) 436-2774
Deanna Caines Teacher/1-6	Hyattville, WY 82428 (307) 469-2205	Manderson Elementary Manderson, WY 82432
Judith Coulter Teacher/4	4622 East 16th Street Cheyenne, WY 82001 (307) 638-1153	Hillsdale, WY (307) 547-3468
David A. Craig Teacher/1, 4-6	2928 West A Torrington, WY 82240 (307) 532-7228	Torrington Elementary 436 East 22nd Torrington, WY 82240 (307) 532-4003
Gail M. Craig Teacher/4	2928 West A Street Torrington, WY 82240 (307) 532-7228	Torrington Elementary 436 East 22nd Torrington, WY 82240 (307) 532-4003
James J. Dever Principal	2614 E. 6th Casper, WY 82609 (307) 237-9867	Poison Spider School P.O. Box 6150 Raderville Route Casper, WY 82604 (307) 472-7904
Mary Feagler Teacher/1, 2	2415 East G Torrington, WY 82240 (307) 532-4723	Torrington Elementary 436 East 22nd Torrington, WY 82240 (307) 532-4003
Pauline Jolley Teacher/2	Rt. 1, Box 18 Hulett, WY 82720	Hulett Elementary Hulett, WY 82720 (307) 467-5231
James Gene Jones Teacher/5, Mentor	82132 Orange Grove Indio, CA 92201 (619) 347-1050	Valley View School 85270 Valley Road Coachella, CA 92236 (619) 398-4651

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
Steven W. Kiley Teacher/4	Box 3465 Gillette, WY 82716 (307) 682-2162	Moorcroft Elementary Box 156 Moorcroft, WY 82721 (307) 756-3373
Carie King Teacher/3	1724 Fetterman #3 Laramie, WY 82070 (307) 742-5719	811 South 17th Street Laramie, WY 82070 (307) 745-4800
Rodney Knudson Librarian/K-12 & Adult	145 Bush Street Hulett, WY 82720 (307) 467-5405	Hulett School 401 Sager Street Hulett, WY 82720 (307) 467-5947
Nina Knuppel Teacher/2	Box 244 Pine Bluffs, WY 82082 (307) 245-3691	Carpenter Elementary Carpenter, WY 82054 (307) 649-2416
Patricia Kottraba Teacher/1	104 W. Campbell Moorcroft, WY 82721 (307) 756-9580	Moorcroft Elementary Box 158 Moorcroft, WY 82721
Judy Krug Teacher/3	109 Arrowhead Road Torrington, WY 82240 (307) 532-3162	Torrington Elementary 436 East 22nd Torrington, WY 82240 (307) 532-4003
Kathleen Lyon Teacher/3	P.O. Box 114 Albin, WY 82050 (307) 246-3457	Albin School Albin, WY 82050 (307) 246-3362
Betsy Mahoney Gifted & Talented	P.O. Box 96 Alva, WY 82711	Hulett Elementary Hulett, WY 82720
Penny McPherson Teacher/4	P.O. Box 755 Moorcroft, WY 82721-0755 (307) 756-3729	Moorcroft Elementary Box 158 Moorcroft, WY 82721 (307) 756-3373
Jack L. Mitchell Science/5 & 6	115 Dayton Drive Cokeville, WY 83114 (307) 279-3458	Cokeville Elementary Box 400 Cokeville, WY 83114 (307) 279-3233
Jean Mitchell Teacher/1	115 Dayton Drive Cokeville, WY 83114 (307) 279-3458	Cokeville Elementary Box 400 Cokeville, WY 83114 (307) 279-3233

Name Position	Home Address Home Telephone	Professional Address Professional Telephone
David R.Nelson Teacher/6	1019 Sanders Drive Laramie, WY 82070 (307) 745-9029	Thayer School Laramie, WY 82070
Georgia Phipps Teacher/6	Sage Hills Subdivision-4 Glen Rock, WY 82637 (307) 436-9048	Poison Spider School 6150 Raderville Rt. Casper, WY 82604 (307-472-7904
Diana M. Schmitt Teacher/6	6007 South View Road Laramie, WY 82070 (307) 721-3978	811 South 17th Street Laramie, WY 82070 (307) 745-4800
Susan Stevens Teacher/3	Box 234 Pine Bluffs, WY 82082 (307) 245-3658	Pine Bluffs Elementary 6th & Elm Pine Bluffs, WY 82082 (307) 245-3634
May Stewart K-8 (Rural)	P.O. Box 1864 Casper, WY 82602 (307) 234-1223	Boxelder Rural School Glenrock, WY 82637
Mary Streeter Sub Teacher	Rt. 4, Box 640 Hulett, WY 82720	Hulett School Hulett, WY 82720
Shirley Westerhausen Teacher/2	1704 Monte Vista Lane Gillette, WY 82716 (307) 682-7497	Moorcroft Elementary 101 Bell Fourche Moorcroft, WY 82721 (307) 756-3373

APPENDIX II

SAMPLE LISTING OF PARTICIPANT PRODUCTS

WORKSHOP PRODUCTS REPORTED BY 1984 PARTICIPANTS

1. Workshop Presentations
    - National
        - 1986 NSTA - San Francisco
        - 1985 National Association of Laboratory Schools - Denver
        - 1985 NSTA - Cincinnati
        - 1984 NSTA - Boston
        - 1983 NSTA - Dallas
        - Physical Science Ideas to Southeast NE Science Teachers

    - State
        - 1987 Imagination Celebration - Buffalo
        - 1986 Imagination Celebration - Buffalo
        - 1986 Science Teachers Association of New York - Ellenville
        - 1985 Kentucky Association for Progress in Science - Louisville
        - 1984 Kentucky Association for Progress in Science - Owensboro
        - 1984 Kentucky Academy of Science - Frankfort
        - 1983 Kentucky Association for Progress in Science - Richmond
        - 1983 Kentucky Association for Environmental Education - Mammoth Cave National Park
        - 1983 Kentucky Academy of Science - Louisville
        - 1986 Buffalo State College
        - 1986 Oakfield - Alabama School
        - 1986 Alden Elementary School
        - 1986 Erie County Elementary Principals Association - Lancaster
        - 1986 Buffalo Teacher Center - Buffalo State College
        - 1986 Attica Elementary School
        - 1986 Maryvale/Cleveland Hill Schools
        - 1986 Buffalo State College
    - Student Group Presentations
        - 1987 South Park High School
        - 1987 St. John The Baptist School
        - 1987 Smallwood Elementary School Science Speakers Day
        - 1987 Lackawanna Public Schools
        - 1986 St. John The Baptist School
        - 1986 Olmsted School
        - 1986 College Learning Laboratory School/Campus West
        - 1986 Grand Island High School
        - 1986 Olmsted School
        - 1986 Nardin Academy
        - 1986 East Oz (Summer Enrichment Program)
    - Group Dynamics
    - Cooperative Learning
    - Cooperative Learning Strategies
    - Concept Mapping Techniques
    - Oceanography Curriculum Modules
    - Discrepant Events
    - Plaget and Science Teaching
    - SESE
    - Energy Education
    - Microcomputer Integrated in the Classroom for Science
    - Mankind: A Biological/Social View, an STS course

Science Curriculum Writing and Evaluation
Interdisciplinary Education in the Secondary Schools
Energy, Science and Middle/Junior High Students
Energy Education in the U.S.
Student Energy Expo's Simplified
Assessing the Needs of Middle/Junior High Science Teachers
Promoting Professionalism and Excellence in Middles and Secondary Schools: A Cross-Cultural Perspective
Using the Computer in the Ongoing Middle/Junior High Classroom
Introducing Technology and Society into the Middle School Curriculum
Using Computers in the Lab
Images of Middle School Science: What Does Your Classroom Look Like?
Science in the Middle School: Standards According to the National Science Teachers Association
Using One Computer in a Class Full of Junior High Science Students
Making Technology and Society a Part of Middle/Junior High Science
STS and the Nature of the Middle/Junior High School Learner
Creating an STS Continum: Setting the Agenda
Microprojector Method of Forming Crystal Systems
Sleuth Boxes I & II
Inference Builders I & II
Science Olympiad
Introduction to Cooperative Learning Techniques
Follow Up on Cooperative Learning
Localizing Your Science Curriculum
Hands-On-Science Activities for Use K-68
One Process Approach Elementary Science Activity After Another
Life Lab Teacher Training Workshop
Advanced Life Lab Teacher Training Workshop
Field Science for Teachers
Teacher F.S.Z.
Encampment Experience
Using Computers in the Classroom
Computer Interfacing
Using STS in the Classroom
Put P.E.P.* Into Your Science Teaching *(Purpose, Expectation, Personalization)
Meeting the Needs of Gifted Science Students
Cooperative Learning In Science
Phase II Life Lab Science Curriculum Development
Introducing Societal Issues in Introductory Science Courses
S.A.S.I., Science and Societal Issues
How To Do "Hands On" Experiments from K-6 to Make Science Fun
Energy Experiments That Relate to Core Competency Tests
KSAM - "Hands On" - Pass Those Tests
Why Students Fail in 7th Grade Science
Science Fairs--How to Do Them
Scientist in the School
Warwick Science Curriculum Workshop
Northeastern Workshop for Teachers
Science Awareness Conference
Curriculum Workshop Title II
Monitoring Water Quality of a stream

Problem Solving in Science
Cooperative Educational Strategies in the Earth Science Classroom
STS in Earth Science Classrooms
Computer Interface in Biology
Computers in Science
Interfacing
Here's Looking at You (Drugs Education)
Computer Literacy to School Faculty
District Curriculum Presentations
Elementary Workshop - Problem Solving
Elementary Workshop - Observation skills using live animals
Responding to Nation at Risk
Innovative Approaches to Teaching Elementary Science
Promoting Higher Level Thinking Skills
Evaluation of a Science Program
Elementary In-Service for 1200 teachers (1986)

2. Professional Activities
    - Middle/Junior High School Advisory Board - NSTA
    - NSTA Area Convention - Presider (at Indianapolis)
    - NSTA National Convention Washington D.C. - Presenter
    - Science Education Council of Ohio State Meeting - Presenter
    - National Science Teachers Association
        - Science Scope (middle school science journal)
        - 1986 Section Editor, "New Teacher Feature"
        - 1982 Article Review Panel, (through 1985)
        - 1982 Advisory Board, (through 1984)
    - State Level
        - 1985 Chair, Science Education Section, Kentucky Academy of Science
        - 1984 Secretary, Science Education Section, Kentucky Academy of Science
        - 1984 Board of Directors, Kentucky Association for Environmental Education (through 1985)
        - 1983 Conference Planning Committee, Kentucky Association for Progress in Science
    - Local Activities with Teacher Association
    - Active Member in Curriculum Committee for Chemistry
    - Iowa Academy of Science Presentation of Group Dynamics
    - Supervision of Student Teachers
    - The State Convention of NUSTA - presentations
    - Member of Steering Committee - NUSTA
    - Member of Steering Committee of Northwest Regional Science Fair
    - Member of Science Advisory Board of State of N.M.
    - PTRA Training - 1986
    - EXETER - 1985
    - AT & T Industry Honor - 1986
    - Ames Community Computer Curriculum Communication
    - Ames Community Computer State of the Art - 1985
    - Instructor at Des Moines Community College - 1987
    - Co-Chaired NSTA Area Convention - Anchorage, Dec. 1986

Steering Committee for Alaska Native American Science Education Association Conference
Won the President - Elect for National Science Teachers Association

Appointed to the Alaska Department of Education Educational Priorities Task Force
Selected to work with the National Science Resources Center in Washington D.C. this summer

3. Writing: Titles of Articles

Books

Biology Test Book
Focus On Excellence: Science as Inquiry
EDF 102 Laboratory Experiences Handbook
Development of the 3rd Source Book for Science Supervisors

Research

"Performance of Students in Grades Six, Nine, and Twelve on Five Logical, Spatial and Formal Tasks - JOURNAL OF RESEARCH IN SCIENCE TEACHING
"Creativity and Science Career Preference of Students Enrolled in the Kentucky Governors Scholars Program - TRANSACTIONS OF THE KENTUCKY ACADEMY OF SCIENCE

Pedagogy/Methodology

"Exceptions can Result in Improvement" - NATIONAL ASSOCIATION OF LABORATORY SCHOOL JOURNAL
"Science for the Bad Days" - THE SCIENCE TEACHER
"SCIENCE SCOPE'S Adolescence" - SCIENCE SCOPE
"Creativity and Research . . . Science" - COMMUNICATOR
"Creative Integration Approaches to Science & Language Arts" - SCIENCE SCOPE
"Onward - Middle/Junior High Science" - SCIENCE SCOPE
"Trimming the Creativity Tree" - THE SCIENCE TEACHER
"A New Look at Middle School Science -- A Creative Adventure" - EDUCATIONAL REVIEW
"Science Evaluation with a Right Brain Component" - COMMUNICATOR
"Second Level Biology: A Contemporary Perspective" - (Sept '86) AMERICAN BIOLOGY TEACHER
"How Dense" - (Oct. 85) THE SCIENCE TEACHER
"My Philosophy of Education" - Submitted for nomination for the teacher of the year award (1987)
"A Science Opportunity - Stimulus Response" - 1984
"Second Level Biology: a Contemporary Approach" - (Sept. 86) AMERICAN BIOLOGY TEACHER
Response for NSSA in the AETS Yearbook, 1987

Audio-Visual Materials

A Program Overview of ModeL Laboratory School
Model Laboratory School: An Institution Where Multiple Learning Strategies Assist in Child Development

Principles of Geology. Parts I & II

Publications In Progress Submitted
Rocks, Rocks, Rocks!

An article for the Science Teacher which focuses on how students simulate rock formation in the laboratory
A spin-off article for LEARNING 87 or INSTRUCTOR which focuses on the Buffalo State faculty colloquium "The Teacher As Actor"

4. Writing: Curriculum Modules/Units/Innovation
   - Nuclear Issues Seminars - Workshop with Speakers
   - Critical Thinking Problem Solving - Order of Magnitude Estimates - Physics Olympics
   - Test Writer - T.L.T.G. for E.T.S.
   - An Ecology Module - Complex Mountain Bionic - entitled "What's Up" - Making use of Co-operative learning Techniques
   - "Mentorship Program" for the Science Classes in the Springfield System
   - "Family Room Chemistry" - was submitted to the National Offices in Washington D.C.
   - "Grant Proposal to the State Offices for Ecological Studies"
   - Continuous updating of the various units taught using group dynamics
   - Incorporated Cooperative Learning Strategies Information
   - Adoption this Fall - very versatile program
   - Restructured presentation of materials to biology
   - Measuring Speed of Light in Optical Fibers
   - Temperature Control Bath for Crystal Growth Using an Apple
   - Computer Use Design Comm. - 1985
   - Keyboard Design Comm. - 1986
   - Keyboard Implementation - 1987 and 88
   - Building Computer Comm. and Inservice 1985 - 87
   - Revised 24 Modules in Elementary Science
   - Consulted with 10 other districts in their development and/or writing of Science Module

5. Scientists
   - Merwyn Larson (Civil Engineer, SD Dept of Transportation)
   - Wes Habritter (Bacteriology, Sioux Valley Hospital, Sioux Falls)
   - Paul Willadsen (Mechanical Engineer, NSP Sioux Falls)
   - Charles Trantwein (Geologist, EROS Data Center, Sioux Falls)
   - Walter F. Soule (Physics & Chemistry, Andover, Mass.)
   - Dr. D. Crandshaw (Biochem, Veterans Adm. Hospital-Research Labs)
   - Dan Hewko (Envinronmentalist, Nolde Environmental Center
   - Faculty, Dept. of Geology (URI)
   - Faculty, Dept. of Oceanography (URI)
   - Faculty, Space Science (Florida Inst. Tech.)
   - Staff Scientists, NASA (JPL & Goodard)

Planetary Center Staff, Astronomy (Brown University)
Faculty, Computer & Astronomy (Comm. College of RI)

6. Curriculum

Cooperative Learning Modules in Earth Science
Acid Rain Activities
Resources Available for Gifted Jr. High Students
Activities for Search for Solutions
Mankind: A Biological/Social View
Teachers Guide to spring 1983 NDVA Programs
Coal Labs for Secondary Science
Exploring for Energy
Water Pollution Module
Environmental Science: An Offshoot Middle School Program
The Growing Classroom (3 volumes)
STS in Chemistry
STS in Science Education
Computers in the Classroom
Cooperative Science Unit on Soil and Erosion
Cooperative Science Unit on Cover Cropping and Nitrogen Cycle
Cooperative Science Unit on Tide Pool Life and Tides
Values in School Science: Some Practical materials and Suggestions
S.A.S.I.; Science and Societal Issues
Problem Solving in Science
Science-Technology-Society

7. Articles

Visualization of Concepts Using the Computer (Science Scope)
A Summer Marine Science Workshop Along the Atlantic Coast (Current Magazine)
Focus on Excellence, STS (NSTA Monograph)
The Nuclear Threat (Curriculum Magazine)
Science and Technology Education for Tomorrow's World (Final Report of Exeter II Conference)
Interviewing for Excellence: A Guide to Exemplary Teacher Characteristics (NASSP)
Why did the Good Die Young: Problems in Implementing Curricula (NASSP)
Operate a Nuclear Power Plant (Science Teacher)
Food Labs: An Approach to Science (Science and the Early Adolescent)
Moving Toward Excellent Science Teaching: Notes from the Precollege Classroom (NSTA Yearbook 1984)
Energy Education and Physical Science (Search for Excellence in Science Education Monograph: Energy Education)
Dialogue on the Nature of Science Education (Journal of College Science Teaching)
The Computer in the Middle/Junior High Science Classroom (Science

Scope)
NSTA Position Statement: Middle/Junior High Science Education (Science and Children)
PR and Community Involvement (Science and Children)
The Bid Game (The Science Teacher)
The Science Corner (The Science Teacher)
The Mini-Trail Lab (Science Scope)
How Science Activities May Make Mathematical Conceptualizations a Reality (Science Activities)
Put a Hood on Your Fumes (Science Scope)
Cooperative Learning: An Experience in One Elementary Classroom
Cooperative Learning At Stillwater High (Stillwater Gazette)
Science Through Discovery: Students Love It! (Science and Children)
Teachers Make Exemplary Programs (Educational Leadership)
Moving Toward a Socially Responsible Future: An Ecological Approach
Science Education and Future Human Needs
Resource Centers: A Response to the Needs of School Science Teachers (School Science and Mathematics Magazine)
On Introducing Societal and Ethical Issues into School Science Courses 1985 NSTA Yearbook)
A New Technique for Teaching Societal Issues (Journal of College Science Teaching)
How to Make a Windsock (Science and Children)
Scientist in the School (Science and Children)
Sports Science (Private Publishers)
Nature Walks (Instructor)
Making Earth Science Non-Traditional (Science Scope)
Why So Few Exemplars (The Clearing House)
The Real World of STS (Pa. Sci, T.A., The Exchange)
Fred the Fish, Supplemental Guide to Colonel Kentucky, Natural Resources & Environmental Protection Cabinet

8. Instructional Strategies
    - Hands-on Activities
    - Cooperative Learning Strategies
    - Individualized Learning Strategies
    - Computer Assisted Instruction
    - Concept Mapping
    - STS Techniques
    - Brainstorming Techniques
    - Mentor System for Students
    - Decision-Making
    - STS Infusion
    - Community Resources in the Classroom
    - The Effect of Piaget's Model on the Teaching of Chemistry
    - Use of the Outdoor School
    - Science for Handicapped Students
    - Problem Solving
    - Hands on Experimentation
    - Primary Lab Outside Classroom
    - Starting with Application/Connection
    - Content Organizers

Values/Issues in Science
STS
Cooperative Learning
Creative-Inventing Strategies
Application/Connection
Community Personnel
Discrepant Events
Creative Thinking
Cooperative Education Techniques
How to Evaluate/Revise an Existing Science Program

9. Proposals
    *NEED in South Dakota 82-86
    *National Energy Foundation
    *AAAS Student Projects in South Dakota
    *Integrating Computer Use into the Science Curriculum
    *Integrating Science Equipment with the Computer
    *Exxon Impact II Grant
    *New York State Science Teacher Re-Training Grant
    *Impact II/CIBA-GEIGY Science Developer Grant
    *Hands Across the Sea Curriculum
    Computers in Science Classrooms
    Optics Resource Laboratory
    *Seminar on Cooperative Learning w/Dr. Roger Johnson
    *Follow up Seminar with Dr. Roger Johnson
    *Science Olympics
    *Title II: Elementary Science, Teacher Development, 1985
    *Title II: Elementary Science, Teacher Development, 1986-87
    NSF, EL & Middle School Teacher Program, Space Science-1985

WORKSHOP PRODUCTS REPORTED BY 1985 PARTICIPANTS

1. Workshop Presentations
    - Channel Islands
    - Local Fauna
    - Galapagos Islands
    - Openers, Thinkers, and Grabbers
    - Ways to Seat Students and Establish a Learning Environment
    - Painless Science
    - Using Literature in Teaching Science
    - Halley's Comet
    - Moon Rocks
    - Acid Rain
    - Field Trips
    - IPD Explanation
    - 3 D's of Discipline
    - Developing Thinking Skills through Science
    - See Yourself as a Scientist
    - Positive School Climate
    - Integrating Science
    - Elementary Science
    - Grantsmanship
    - Project AIMS: Activities That Integrate Math & Science
    - Earthquake Preparedness for Parents
    - Integrating Math/Science/Computers: Body Measurements
    - Helping Your Child Improve Academically
    - Adolescent Sexuality in the Traditional Biology Curriculum
    - Why Focus on Social-Ethical Issues in Biology Classes
    - Technology-Disease-Society: Understanding Their Connections
    - Exeter-STS
    - Interfacing Experiments to Computer
    - Duck into Science
    - Cooperative Learning Application in Elementary Math
    - Cooperative Learning Techniques and Methods
    - Strategies for Teaching Gifted Science
    - Hands on Science for K-3
    - Hands on Science for 4-6
    - Hands on Science that Teaches Thinking Skills K-6
    - Using Hands on Science to Teach Questioning, Reasoning, and Thinking Skills K-8
    - Plant a Seed for Science
    - Cocoon Shredders
    - The World's Greatest Rock Groups
    - Wear a Lesson
    - Baggie, Fizzy, Science
    - Animal in the Classroom or What to do in Case of Snake
    - STS in the Classroom
    - Landsite Evaluation - Real World Research with Real World Implications
    - Weather or Not To Teach Junior High Meteorology
    - Earth Science for the Real World
    - Elementary Energy Curriculum
    - Motivating Students in Science

Elementary Student Performance Standards in Science
Marine Science Activities
Family Science Festival, Pasco Co. Schools
Developing, Maintaining and Evaluating Process-based Elementary Science Curriculum
Sciencing for Teachers
Do Your Science Students Know How to Learn?
Computers in Earth Science
Field Trips to the Hall of Dinosaurs
Teaching Space History in Our School
Problem Solving: Questioning and Integrating
Kaleidoscope: Integrating Science into the Curriculum Using Children's Literature
So You're Going to Give A Workshop
Genetics Workshop
Computer Workshop
Using Computers in the Elementary School
Computers in Education: An Update
How Do You Create an Exemplar Unit
Coordinating Social Studies With Science
Chemistry
Secondary Schools Approaches to Critical Thinking Skills
Critical Thinking Skills & the Scientific Method
Conservation for Today and for Tomorrow
Environmental Education
Energy Education
What Makes A Good Middle/Junior High School Science Program (Minn. Council for Gifted and Talented)
Middle/Junior High SESE Programs
The Anatomy of A Science Department: John Adams Junior High
The John Adams Approach
Secondary Schools Approach to Critical Thinking Skills
S.U.C.C.E.S.S.
Rewards & Awards
Bytes from a Science Teacher's Apple
Energy Education In-Service (plan varies in relation to audience)
Beginning to Use Computers
Computer Software
Hands on Science for K-5 Teachers
Process Approach Science
K-12 Science Fairs (K-3, 4-6, 7-12)
Hookers and Grabbers
Oobleck and Scientific Method
Group "IT" (Investigation Task)
PACE (Preview and Curriculum enrichment)
SSI (Summer Science Institute for Elementary Teachers)
Can We Teach Them Social Responsibility in a Technological Society?
Owls, Hawks, Snakes & Wild Critters
Concerns and Needs of M/JH Teachers
How to Give a Workshop
Hiking up Mt. St. Helens
STS course curriculum
Putting It All Together
Take 5 for Science

STS - What, Why, and How?
Elementary Science - Principles and Processes
Science for Accelerated Learners
"Rocketry for Rookies"
Summer school classes at local junior college (kids 9-14 yrs. old)
Teacher in space activities
NSTA - 1986
Computer Assisted Instruction
Marine Education Workshop
Family Life and Human Sexuality
Assessing Outcomes of Lab Activities
Gifted and Talented
Marine Science
Cooperative Learning
Elementary Science Text Series
CBAM
Use of Computers in Science
Use of Voyage of Mimmi Holt
Elec. and Mag. for Elementary School
Managing Elementary School Science
Light and Vision (Elementary School)
Elementary Science - Sound Changes
STS
Gifted and Talented
Science Careers - florist
Volcanoes, Not just Science
Connect Day IV ... P.E.P. (Poss' Energy Posse) (2) Nov. 1985
Connect Day V ... Wallingford Schools Match Energy Wits (1) Nov 1986
NSTA Conference...San Francisco, CA .. P.E.P.(1) April 1986
NSTA Conference..Washington, D.C. .. Schools Match Energy Wits March 1987
NSTA Conference..Washington, D.C. .. Your Career in Energy/Energy in your CA.
1986-1987 Professional Development Workshops (by grade levels .. Super 7's - The Best of the West..and all the Rest K-T-1-2-3
ITIP (madeline Hunter)
A Biology Seminar for Teachers
STS for Teachers
Student's Cognition
Using Children's Literature in the Teaching of Science (W.O.R.D., WSTA, WAACD)
How to Use Bill Martin Books (W.O.R.D.)
Listening Skills (Honeywell Corp.)
Discipline (ISEA)
Interdisciplinary Units (NASTA)
Elementary Science Fair (NSTA)
Thinking Processes (School Dist.)
A.P. Biology Workshops (A.P., ISTA)
Environmental Impact Hearings (NSTA)
Trends in Science Education
Teaching Elementary Science in the 80's (School)
Trends in Science Education for the 80's and Beyond (P.A. Assoc.)

Human Sexuality and Biology Curriculum (NABT)

Bioethics (NSTA)
Teaching Strategies - Bioethics (March of Dimes Foundation)
Controversial Issues - STS (NSTA)
Adolescent Sexuality-Biology Curriculum (Science Council, S. Carolina)
Outdoor Science Curriculum-Inservice (Outdoor Education Center)
Hands On Demonstrations (Phillipines 14 schools)
Vermont's Unique ELF Program (NSTA National Convention)
Openers, Thinkers and Grabbers (NSTA National Convention)
Teaching Strategies (Inservice workshops)
STS Units (86 and 87 NSTA)
Keep Them Interested-Ideas from Dreyfus (87 CAST)
STS Units (86 CAST)
How to Judge a Science Fair (Hillsborough County Sci. Teachers)
Developing Creativity in Gifted Students (Gifted Leadership Institute)
Strategies for Teaching Gifted Science Students (NSTA)
Analytical Chemistry in the Classroom (FL Assoc. of Sci. Teachers)
Cooperative Learning (So. FL School Volunteers)
Cooperative Learning Techniques (Staff Development)
Duck Into Science (GSTA)
Interfacing Workshop (WSTA)
Motivation and Self-Concept (Univ. of IL, Chicago)
Exter (New Trier H.S.)
100 Ways to Improve Self-Concept (IL Renewal Inst.)
STS Project-Thinking Skills
Energy of the Past, Present, and Future (1985 NSTA)
Science on a Shoe String (6 Area School District)
Science, Technology, and Society in the Classroom (Arch-diocesan Conference-Science Teachers)
Using "Search for Solutions" to Teach Science Process Skills (OSTA)
Do Your Science Students Know How To Learn? (1986 NSTA Convention)
Computers in Earth Science (1985 Fairfax Earth Science Teachers Assoc.)
Field Trips in the Hall of Dinosaurs (Smithsonian Museum of Natural History)
How to Develop, Maintain, and Evaluate Process-based Elementary Science Curriculum (NSTA)
Use of OBIS Activities (LEEF State Conf.)
Pasco County Family Science Festival (PACTS Conf.)
Activities for Energy Education (NSTA, 1985)
Take That Laser Out of the Closet (FAST State Conf. 1984)
Duck Into Science (W.S.S.T.)
Kaleidoscope - Integrating Science Using Children's Literature (W.S.S.T. & Wis. Academy of Science, Arts & Letters)
Teaching Space History in our Schools (KS Assn. of Science Teachers)
Project Wild (S.C. Science Council '84)
Speed Reading with Increased Comprehension (NABT Purdue Convention)
Bioethical Decision Making (NABT 1986 Convention)
The Geology Field Trip as an Earth Science Activity (PSTA)
Cooperative Teaching Strategies for Use in Earth Science Classrooms (NSTA)
More Cooperative Teaching Strategies for Use in Earth Science Classrooms (NSTA)

Science With Your Children (Roosevelt Elementary PTA)
Booth/Fickett - Math/Science Magnet Program (NSTA)
AIMS (ASTA, 1986)
Energy Education - NEED (NSTA)
Computers for the Classroom (Love Cty. Teachers)
Teen Teachers
Moving OFF-Stage: Promoting Higher Level Thinking Skills In Interdisciplinary Approach to the Study of Space Exploration

2. Professional Activities

Member NSTA, attended regional & national conventions this school year
Participated in state convention - presented slide show on Mt. St. Helens
Board of Directors - NTA - Preschool/Elementary Director
Board of Directors - CESI
Board of Directors - MSTA (MN. Science Teachers Association) - Elementary Directors
Presented at every NSTA last year(4) 2 times the year before
Present at our 2 state conventions yearly
Organized and put on a state wide elementary workshop
Taught and helped organize ESTIP for MSTA
USTA Fall Conference October 1986 - "STS - A Relevant Approach to Science"
UATA Mid-Winter Conference February 1987 - "STS - What, Why and How"
President USTA - 1986, Past President USTA 1987
District wide workshop presentation on Space/Model Rocketry for elementary teachers - 3 days
Attending NASA Teacher-in-Space workshop in New Orleans June 26-July 1
Consultant to Science and Engineering
Concepts program being developed by Georgia Tech. and Georgia State Universities for developing a program introducing technological concepts into middle school curriculum.
Family Life Workshop
N.J. Educational Association - State Convention at Atlantic City - "Marine Science"
1986 - NSF - Developed 12 Curriculum Modules in Marine Science that can be integrated into Basic Science Curriculum 9-12
1987 - NFS - Summer Institute in Bio Technology at Univ. of Rochester N.Y.
1987 - N.S. Science Teacher - 1 of 10 teachers in Honors Industry Workshop at AT.T. (to develop workshops)
Presentations at NSTA, 1986: 2 workshops
Presentations at NSTA, 1987: 2 workshops
Attended NSTA convention - Washington D.C.
Livermore School Districts Science Advisory Council
NSTA - Washington D.C. National Convention (presentation)
Santa Claire County Science Convention (presentation)
Alameda City Schools Science Convention (presentation)

Will be presenting at San Antonio and Miami Regional NSTA
Mentor Intern Program
Earth Science In-Service
Committee to revise general Earth Science Curriculum to meet Regents Complementary Test
NSTA Regional (Las Vegas)
NSTA Regional Salt Lake City - will present
Will be presenting this October 16th, 1987 at NSTA
Science Liaison for Robson on district wide committee
Chairperson County Soil District Enviromental Education Committee
State Presidential Award (one of 3 national winners)
Pride of Pattonville Award - May '87 (honored in Govenors office - Oct '86)
PTA Service Award '86
Appointed by State Commissioner of Education to represent MO. at Captiva Island, Florida Syposium
Speaker - "Montgomery Landingsite, Marine Eocene (Jackson) of Central Louisiana "Symposium, Gulf Coast Association of Geological Societies
President - Northeast Louisiana University Geology Foundation
Sigma Xi Award for Outstanding Contributions to Science Teaching in Louisiana
Odaho teacher of the year 1986
Intermountain Junior Science and Humanities Syymposium at the University of Utah - 5 students presenting
Idaho Science Teachers Convention - "Presidential Award for Excellence"
Selection Committee for Idaho Residenial Award
Selection Committee for Idaho Biology Teacher of the Year
Grant Reader for National Science Foundation
Presentation to Idaho Educational Association Delegate Committee on "Excellence in Education"
Presentation to Snake River School district "What You Can Do"
Presentation to State of Idaho Senate and House of Representatives on "What's Good About Education"
NSTA Convention Evaluator
Appointed to Utah State STS Committee
Co-Chaired an STS Workshop for Weber School District Science Teachers

3. Writings: Titles of Articles

Principle role in Elementary Ed. - (1986) Principals Magazine
Chairman os STS Physical/Earth Writing Team for Curriculum Package
Plants and Animals in Nature Book published
"What's New in Science" - (November 1985) SCIENCE SCOPE
Students Teaching Students: A Valuable Resource - Science and Children (Fall 1986)
An on Gregor Mendols Document in the works
Marine Biology - part of a book to be published by Univ. of Delaware
"Your Students Can Be Gems" -(Spring 1986) SCIENCE SCOPE
Community Resourses in Science - (1987)
"Mt. St. Who? - (1987) NATIONAL MIDDLE SCHOOL JOURNAL
"Transescent to Gain a Staff" - (March 1986) MO. MIDDLE SCHOOL JOURNAL

3 Experiments for the book Science Experiments on File - (Spring '88)

"Teleosteam Otoliths and their Paleocological Implications at the Montgomery Landing Site", Proceedings of a Symposium, (October 1986) GULF COAST ASSOCIATION OF GEOLOGICAL SOCIETIES

"You Buy"... Consumer Economics for Middle School Students...(1986) NSEE

"Buyer Be Aware"...Pupper Play for Primary Grades... (1987) NSCEE

Determination of Genetic Influence on Taste Preference - (June 1987)

4. Writings: Modules/Units/Innovation

Co-authored an interactive video disk program for intermediate students

Consultant work for other school districts

Wrote units on weather on entering mappings for the school district

Working on curriuculum writing for the district at present

Combine math and science in extra projects of Gifted Classes

"Learning Activities for the STS Physical - fourth science course

Co-author and Co-editor of the above activity guide of strategies, suggestions and activities for teaching the STS core science course in physical/earth topics

"Rocketry for Rookies" is being "polished" for possible publication for fall

Science and Engineering Concepts of Salt - (Book)

Science and Engineering Concepts of Sharks - (Book)

Science and Engineering Concepts of The Making of Paper - (Book)

NSF s[pmspred Grant No. MDR-8470198

Human Sexuality Curriculum Units K-12

Substance Abuse Curriculum Materials

Developed Marine Science modules or units

Developing a Biology course for Vocational students in fields related to Biology - Ex.) Enviromentaol Science, Foods, Horticulture, Plumbing, Practical Nursing, etc.

Continued to up-date Life Science, 7th grade course

STS Consumer Chemistry Unit

Drug Literacy Magazine (from STS course) Presented and taught to Elementary Students

STS Science Fair - projects from students presented to classes at Prairie

Finished STS for 8th grade - 1 semester course

Writing for SSEC - a grant to write STS material for junior high

Taught a semester course in Cooperative Learning

Wrote $12,000 Grant for Computers inClassromm (funded 1987)

Received $3,700 Grant for 25" monitors and software, 1986

Received $1,500 Grant for Staff Inservice at School (using computers)

Set up California Earthquake Ed. Project training for district and obtained materials to support project for all district middle schools.

Projects HOPES - $300,000 NSF Grant funded - Proposal designed and written - funded for 2 years to work with a partnering between scientists and Elementary School Teachers

General Earth Science Module

Lesson Plan using Format

General Earth Science Examination

Imagery in the following area:geology, geography, envirromental

science, and polulation expansion and dynamics
Project Earth - An Ecological Stone of Central Florida and the Smokey Mountains
Adopted 2 miles of state highway for litter pick-up
Planted zoo cypresses donated by paper company
New Science Adaption
New Health Adaption
Simulation: Hazardous Land Use
Module on Enviromental Science (Wastewater Treatment and Indoor air Pollution) for state wide use in Louisiana
Best of the West .. And All The Rest ... Teacher Workshop Adjusted for Elementary Classrooms
Your Career in Energy/Energy In You Career ... Classroom Serie with Science Resource Teacher Grade 2-5
Your Career In Science/Science In Your Career ... Classroom Series with Science Resource Teacher Grade K-5
Advance Placement Biology Curriculum Guide
Biology High Level Thought and Test Questions
Develop a Unit on Science Fiction Appreciation and Understanding

5. Scientists

Don Orlich (Education, WSU)
Phil Leino (Botany, Univ. of Idaho)
Alan Fazara (Physics, MIT)
Bill Wright (Engineering, MIT)
Villnus Kowolkis (Physics, Raytheon)
Herb Brunkhorst (Natural Sciences, W.S.C./L.B.S.)
Pete Goodell (Agriculture, U. of C. Coop. Extention)
Pete Sutherland (Biology, Chevron)
Diane Mitchell (Botany, Native Plant Society)
Dr. Trent Stephens (Embryology, ISU)
Dr. Wicklow Howard (Botany, BSU)
Dr. Centanni (Microbiology, BSU)
Dr. Charles Baker (Entomology, BSU)
Dr. Fritchman (Invertebrate Zoology, BSU)
John Penick (Science Education, Univ. of Iowa)
Ron Bonstetter (Science Education, Univ. of Nebraska)
William Kyle (Science Education, Univ. of Conn.)
Dr. Jeremiah Mahoney (Genetics/Pediatrics, Yale Univ.)
Dr. Joseph Coleman (Molecular Genetics, Yale Univ.)
Dr. Peterson (Immunology, Northwestern Med. School)
Tom Hopkins (Engineering, Florida Advisory Council)
Judith Brueggman (Zoologist, FL Advisory Council for Science Ed.)
Graig Shaak (Geologist, FL Advisory Council)
Joel Feard (Engineering, FL Advisory Council)
Mike Zerofsky (Engineering, FL Advisory Council)
Tim S. Clark (Chemistry, Gas and Electric Company)
Randy Ledford (Naturalist, Okla. Wildlife Conserv.)
Dr. Black (Prof. Turtle Specialist, OBU)
Greg Shearer (Chemistry, Creighton University, Omaha, NE)
Norm Blake (Marine Biology, Univ. of South Florida)
Prof. McSween (Geology, Univ. of Tennessee)

Dr. Pennington (Physiology, Medical Univ. of S.C.)
Dr. Lang (Dermatology, Medical Univ. of S.C.)
Dr. Brown (AIDS Research, Univ. of S.C. Med School)
Dr. Postic (AIDS Research, Univ. of S.C. Med School)
Dr. John Herr (Botany, Univ. of S.C.)
Dr. Dori Helms (Biology, Clemson University)
Dr. Robert Powell (Plant Physiology, Converse College)
Max Awry (Space History, Kansas Cosmosphere, Hutchinson, KS)
Gene Vaughn (Biology, Duke Power Co.)
Dr. John Peck (Solar Engineering & Design, Env. Research Lab, University of Arizona
Dr. Gordon Johnson (Physics, Northern Arizona University)
Dr. Ray Tamparri (Biology, Northern Arizona University)
Dr. William Davis (EPA, Fish Research)
Dr. Homer Schmitton (Aquaculture, Auburn University)
Joel Ostroff (Biology, B.C.C.)
Dr. Malcolm (Earth, B.C.C.)
Fred Johnson (Physical, B.C.C.)
Dr. Gary Duke (Ornithology/Raptors, Minnesota University)
Dr. Richard Bauer (Animal Pathology, Northwoods Wildlife Center, Minocqua, WI)
Dr. Erich Klinghammer (Candid Behavior, Wolfpark, Purdue University, West Lafayette, IN)
Dr. Terry Schultz (Raptor Propagation, University of California at Davis

6. Curriculum
   Channel Islands (Filmstrip and tape cassettes)
   Local Fauna of S. Florida (Slides and Script)
   Galapagos Islands (Slides and VHS)
   Course Outlines and Methods for 10th Grade General Biology
   Course Outlines and Methods for 11th and 12th Grade Botany/Physiology

   Course Outlines and Methods for 9th Grade General Science
   Growing Up Growing Older
   Light Energy
   Grocery Store Shopping
   Energy Application for 5th Graders
   The Search for Super Bubble
   Curriculum Guide for Advanced Placement Biology
   Kern County Science Curriculum Guides K-6
   Problem Solving in Science
   Now You See It, Now You Don't
   Hands-On Nature: Information and Activities for Exploring the Environment With Children
   Silent Migration
   Butterfly Station
   Magic from Inscense
   Wear A Lesson
   Creating, Convening and Conventioneering
   Basic Chemistry: A Low Level Consumer Oriented Science

Threats to our Lives: Pollution
Genetic Engineering: A Plus or A Minus
Aids: Case Studies in the Making
Earth Science for the Real World
Landsite Evaluation
Portable Solar Collector
A Program of Studies for Earth Science in Fairfax County
A Summer Geology Field Trip for High School Students
Using WeatherVision in the Earth Science Classroom
Kaleidoscope (Has mnay hands-on activities for teachers)
Key for Identification of N.E. Leguminous Plants
John Adams Science Department-Energy Awareness, Lab Station Mode)
Energy Mouse-A Problem Solving Approach
Energy Education
The Environmental Education Center at Thunderbird - Curriculum Guide
Can We Teach Them Social Responsibility in a Technological Society?

7. Articles
    Science Program for 6th Grade
    Halley's Comet
    Don't Answer That Question! (WSTA Journal)
    The Secret Answer Box (WSTA Journal)
    Technology-Disease-Society: Understanding Their Connections (Celebration of Excellence)
    Sun Calendar (Instructor)
    Silent Migration (Science Scope)
    Wear A Lesson (CESI NEWS)
    The Case of the Missing Annelid
    "Scientific" Seating
    ELF Opens the Door in Nature Study (Exemplary Practice Series: Outdoor Education by CEDR, Phi Delta Kappa)
    Synergy (The Science Teacher)
    Using Hands On Science to Teach Thinking Skills (The Science Teacher)
    Program Debugging in Teacher Training (WY Computing Teacher)
    Weather or Not to Teach Junior High Meterology
    The Use of Peer Tutors for Teaching Science to Low Ability Students (The Oregon Science Teacher)
    Final Exam by a Forest Stream (The Science Teacher
    Computer Assisted Laboratory Science (Focus On Excellence)
    Advanced Placement Biology (The American Biology Teacher)
    Kaleidoscope (A Newsletter for K-3 teachers, published by WI Academy of Science)
    A New Dimension in Environmental Education (Lake Wylie Magazine, South Carolina)
    Perspectives: North & South (Energy & Education Newsletter)
    Go, Team Go! (The Science Teacher
    STS Revisted (National Exemplar)
    Do Worms Have Feelings Too? (Science & Children)
    Of Wolves and Porcupines: Fables for Beyond the 21st Century

8. Instructional Strategies

- Use of Games
- Cooperative Learning
- Using Community Personnel
- Methods of Grouping Students
- Techniques for promoting thinking skills
- Demonstrations
- Cooperative Learning
- Hands-on Activities Gathering Specimens
- Questioning Techniques
- Hands-on Activities
- STS Techniques
- Webbing
- Use of Simulations
- Cooperative Learning
- Hands-on Activities
- Learning Cycles
- Magic in Science as a Motivator
- Use of Community Personnel
- Cooperative Learning
- Demonstrations
- Working with Gifted Students
- Role Playing
- Cooperative Learning
- Workshop Techniques
- Hands On Activities
- Constructive Learning
- Cooperative Learning Strategies
- Creative Problem Solving Techniques
- Presenting Workshops
- STS in the Classroom
- Attention Getting Devices
- Hands On Activities
- Audience Participation
- STS in the Classroom
- Discrepant Events
- New Computer Programs
- Energy Games
- Taping Yourself as a means of Evaluation
- Use of Computers as a tool for Critical Thinking
- Using High School Students to Teach Elem. Students
- Use of Community Personnel
- Use of Experiences Outside the Classroom
- Constructing Individual Learning Modules
- Cooperative Learning
- Learning Cycles
- Use of Discrepant Events to Motivate and Interest Students
- New Applications of Computers
- Discovery Approach
- Establishing Criteria in Evaluating Software
- S/T/S Applications
- Cooperative Learning

Learning Cycle
Questioning Techniques
Problem Solving Techniques
Motivators, Fast-Fives, Operas
Discrepant Events (use of)
"Magic" Sciencing
Effective Use of "Grabber's and Hooks"
Sharing of Ideas
Networking with others
STS Questioning Skills

9. Proposals
    - Governor's Grant Science Proposal - New Jersey
    - *$15,000 GTE Gift Grant
    - *Horace Mann Grant
    - *CTIIP 1984-1986
    - CTIIP 1987
    - M.S.Computer Resource Room
    - Computer Education 6-12
    - *San Francisco Math Collaborative
    - *Middle School Science Summer Program
    - *San Francisco Consortium Math & Science Council
    - W.E.E.R. American Chemical Society Mini Grant
    - STEAM Grant through ASTC
    - *Salary Revision Proposal for Mercy High School
    - *Purchase and Addition of Portable Computers (NANS Funding)
    - *Purchase of Large Screen Monitors for Computer and VCR's (NANS Funding)
    - Family Science Festival (American Chemistry Assoc. Funding)
    - *Computer Assisted Laboratory Science
    - *Refurbishing the McLean High School Observatory
    - *John Adams Science Dept. Energy Awareness Lab Proposal
    - *Energy Mouse - A Problem Solving Approach to Physical Science
    - *Exxon Corp. Grant
    - *National Gardening Assoc. Grant
    - *To AZ Enenrgy Office Oil-overcharge Funds: Curr. Deve. In Energy Education
    - *To AZ Energyoffice Oil-overcharge Funds: NEED
    - To AZ Energy Office Oil-overcharge Funds: Solar Connection at B/F M/S Magnet
    - *HOPES-Helping Our Partners Enrich Science
    - Elementary Full Time Science Teacher

WORKSHOP PRODUCTS REPORTED BY 1986 PARTICIPANTS

1. Workshop Presentation
    - NSTA Chevron Workshop
    - Renewable Energy
    - Davis County School District Elementary Workshop in Science
    - Endangered Species of S. Florida
    - Computer Software in Science
    - Science Fair Evaluation of County Projects
    - Ecology Day
    - Informal Grade Level Presentation
    - STS Utah State Workshop
    - Elementary Teachers Science Update
    - STS Introduction
    - A.P. Workshop
    - Research Projects in Biology
    - Elementary Hands-On Science Demos
    - Environmental Impact Hearings
    - Chautauqua
    - Iowa Southern Utilities (Energy STS)
    - Pollution
    - Inservice-School Staff
    - STS Curriculum Models/Examples
    - Teaching Plants and Animals/Concepts & Process Skills
    - Plant & Animal Life/Techniques and Strategies
    - Plant & Animal Life/Materials & Computer Software
    - Energy Ethics
    - Energy House
    - Skunk Dam Project
    - Great Investigations-One Step At a Time
    - Investigations in Physical Science
    - CBS Through SBC
    - SBC For Teaching SBC (Some Basic Confidence for Teaching System-Balance-Change)
    - Great Investigations: One Step At a Time
    - Toxic Trails
    - You Look Just Like...
    - Primary - SBC, Science Methods
    - CBS through SBC
    - "Using Discovery Teaching When Covering Content"
    - "Children as Inventors and the Use of the Triple Beam Balance Scale"
    - Summer Camp - Ranger Rick (1987) New York
    - An Aerobic Digestion
    - Basic Chemistry
    - RCRA and Small Businesses
    - RCRA and POTW's
    - Chautauqua Workshop
    - "How to Incorporate STS Concepts Into a Typical Science Curriculum"
    - Science in Early Childhood Education
    - How to do an Elementary Science Fair Project
    - Science for Preschool Teachers
    - Middle School Lab Safety
    - Math Make It - Take It

Creative Writing Workshop: A Right Hemisphere Approach to Composition through creative and critical thinking
Health Make It - Take It
Science Content and Minimum Basic Skills
Problem Solving and Higher Order Process Skills
Using the Binocular and Monocular Microscopes and Preparing Slides

2. Professional Activities
    - Division of Public Schools Convention Presentation - "Science Olympics"
    - Hills City Regional Science Fair Steering Committee
    - F.A.S.T. Convention Presentation
    - Pasco City School - Presentation "How to Survive Your Child's Science Fair Project"
    - Spoke before the Board of Directors of Iowa Southern Utilities on STS in the Classroom (August 1986)
    - Spoke at AEA6 Math Workshop on the Use of Calculators in Science and Math
    - Spoke at Middle School Math Conference at UNI on the Use of Calculators in Science and Math
    - Invited presenter at Annual Convention - Florida Association of Science Teachers
    - Appointed to new position - Area Curriculum Specialist - Science, Broward County
    - Florida Council (1983 and 1986) on Elementary Education - Creative Teaching Grant Winner
    - Presentation at the 1986 Public School Education Conference in Orlando
    - Presentation at the Florida Council of Teachers of Mathematics 1981 Fall Conference
    - Presentation at the Net Education Training Coordinator's Meeting in Atlanta, Georgia (1985)
    - Presentation at the Doe/Fahperd Summer Workshop at the University of South Florida (1985)
    - Received a Scholarship from the Broward County Audubon Society, to attend the Audubon Ecology camp in the West
    - Presentation at the Florida Council of Teachers of Mathematics Fall Conference (1984)
    - Curriculum Council Representative 1983-84
    - Inservice Facilitator 1981-1985
    - Grade Chairperson 1983-85, 1986-87
    - Facility Advisory Council Member 1985-87
    - Co-Chairperson for Norcrest Elem. School Marketing Committee 1986-87
    - Academic Competition Coordinator 1985-87
    - Career Coordinator 1985-87
    - Norcrest Elem. School Science Contact Person 1985-87
    - Committee Member on Week of the Ocean Marine Fair 1985-87
    - Presenter at the Food and Nutrition Management's Fall Conference 1986

3. Writing: Titles of Articles
    - Great Investigations (Resource Book) (1984/revised 1987)

Super Science Sourcebook (February 1987)
Health and Physical Fitness Invention Expo (March 1987)
Child Care Grant for Iowa City Community School Districts Alternative High School Submitted May 1987
1/2 finished with a small manual on the Resource Conservation and Recovery Act and How it Affects Small Businesses (will be published in August)
STS and the Learning Cycle - Chautauqua Notes Featured October or November 1986
Scitoons in the Classroom - Chautauqua Notes Featured February 1987
Scitoons in the Classroom - Sparks Featured March 1987
Scittons in the Classroom - Science and Children Submitted February 1987
Middles School Activities - FAST Journal (Fall, 1986)
Seeds of Learning - CESI Sourcebook, IV (Fall, 1986)
Magic Wind - CESI Sourcebook, IV (Fall, 1986)

4. Writing: Curriculum Modules/Units/Innovation
Very minor changes in Curriculum
Energy and the Environment - Copy on file at University of Iowa
Light - An STS unit - Copy on file at University of Iowa
School-Wide Health and Physical Fitness Invention Expo/Videotape
Junior Inventors Hall of Fame - Instructional TV Presentation - Broward County Schools
Science Fair Project - "Column Strength and Diameter" - Best in Show - Grades 4-5 - Broward County
Higher Order Thinking Skills Project - Inferences in Science Education - 6th Grade Unit
An 8 week Curriculum for Activated Sludge
An 8 week Curriculum for Lab Management and Safety
Adapted Technology updates to circulation unit
Incorporated societal issues on birth and new means of fertilization in a family living course
Societal issues were incorporated into a drug use and abuse unit - Still working on this
Consultant/Author Florida state grant for bilingual education in science
Author/Director Florida state grant for training middle school teachers and administrators in laboratory Management and Safety
Developed Primary and Intermediate Activities for the Health Journal Newsletter
Developed Primary and Intermediate Units for Nutrition Educational Training Project (K-6)
Illustrated Health Curriculum Guides (K-5) in 1983
Developed Science Activities for Standards of Excellence (1984)

5. Scientists
Ken Roettger (Chemistry, Iowa Wesleyan College)
Dr. Jay Hackett (Author, Merrill Pub.)
Lyle Kochinsky (Endangered Animals, Nova Univ.)
Debbie Wade, (National Park Service, Everglades National Park)
Allan Sosnow (Environmental Director, Port Everglades Authority)
Dr. Nancy Romance (Curriculum Director, Laidlaw Pub.)
Bob Yager (Science Education, Univ. of Iowa)

Joan Tephly (Science Education, Univ. of Iowa)
Dr. Steve Spector (Microbiology, Research, USF
Judges (All Fields, Universities and private sector)
Steve LeKewa (Conservation Comm. St. of Iowa)
Dr. Joe Masuu (Statistics, Univ. of South Florida)
Dr. Demetrius Halkias (Microbiology, USF)
Dr. John Russell (Medical Research, USF)
Eldon Grinn (B.A. Science Education, Museum of Science & Industry)
Steve Fleck (Environmentalist, Professional)

6. Curriculum
    - Endangered Species of South Florida
    - Curriculum Science Software-Computer Use
    - Evaluation of Science Fair Projects-County Science Fair
    - Pollution
    - Electrical Energy
    - Nuclear Energy
    - An Introduction to Forces, Motion, and Toys
    - Photography
    - Fun in Physical Science - Activities
    - Seatbelt Science
    - Water As A Resource
    - Its A Dirty Job - But Somebody Has To Do It
    - Simple Machines
    - Sink/Float
    - Oceans
    - Classroom Animals
    - A Project Approach to Environmental Science
    - Earth Science Lab Activities
    - Gifted Health Curriculum
    - Honeybee
    - Energy
    - Toxic Trials
    - You Look Just Like
    - Issues in Nuclear Chemistry
    - PS3 = Problem Solving for Safe Sex

7. Articles
    - Seatbelt Science (Technology Teacher)
    - Water As A Resource (Iowa Chautauqua News)
    - Its A Dirty Job - But Somebody Has To Do It (Mineral Resources)
    - The Estuary: A Balance of Forces (FL Dept. of Natural Resources)
    - You Look Just Like...
    - PS3 - Problem Solving for Safe Sex

8. Instructional Strategies
    - STS Techniques
    - Higher Level Thinking Questions
    - Inquiry Method of Teaching Science
    - Use of Community Personnel
    - Decision-making Strategies
    - Hands-on Activities
    - Critical Thinking Skills
    - Science Labs Set Ups

Cooperative Learning
Use of Community Personnel
Decision-making Skills
Student Action for Problem Resolution
Labs Outside Classroom and School
Webbing
STS Techniques
Hands-on Activities
Science is Day to Day Process
Primary Laboratory Outside Classroom
Starting with Application/Connection
Use of Newspaper
Use of Community Resources
3-minute Stimulators
Concept Mapping
Webbing
Brainstorming
Value/Decision-making Strategies
Implementation Techniques
Role of Facilitator vs. Teacher
Problem Solving Techniques
Use of Computer/Phone Data Collection
Concept Mapping
STS Techniques
Team Teaching
Video
Debate
Role Playing
Field Trips
Science Expo
Displays
Letter Writing
Use of Newspaper for Current Issues
Grouping Strategies
Using Science Processes in Reading, Language, Arts and Math Inquiry
Brainstorming
Curriculum Materials were Shared
Use of Student-Generated Ideas
Creative Projects to Demonstrate Learning
Emphasis on Concept Development

9. Proposals
    *Iowa Writing Project
    Mini Grant funding for outdoor environmental center
    *Audubon Adventure Club (free membership for students)
    Energy Education Program
    Desert Energy Education Project
    *CTIIP Grant (week of Outdoor School for 5th graders)
    Commodore Computer Proposal
    *Environmental Grant for Nova Eisenhower Elementary
    Earth Science (Gifted) Laboratory & Activity Manual
    Earth Science Mid-Term & Final Examination
    Earth Science Mid-Term & Final Examination
    *Curriculum Development

Red Haw Pride Project (Iowa Science Foundation)
*Junior League Mini Grant 1985 & 1986
*Economic Grant
*Summer Science Camps/Institutes (Funded By State of FL)
*An Encounter With Manatecs
*Faculty Study - Project Approach to Science/Computer Literacy
*Science Ambassadors
*Mobile Aquatic Investigation Labs
*Project Approach to Environmental Science
*Estuary: A Balance of Forces (FL Dept. of Resources)
STS
Environmental Education GrantFL: Compiled Activities for Environment. Activities for 2 grade levels (4/5 gr.)
Co-Author of STEAM grant for Museum of Science and Industry in Tampa: To Develop and Implement Elementary Inservice at Museum

APPENDIX III

WORKSHOP STAFF FOR EACH SUMMER AND EACH PROGRAM

WORKSHOP STAFF FOR EACH SUMMER AND EACH PROGRAM

	DATES
Robert E. Yager, Project Director Professor of Science Education The University of Iowa Iowa City, IA	1984-88
Ronald Bonstetter, Project Coordinator Professor of Science Education University of Nebraska Lincoln, NE	1984
Joan Tephly, Project Coordinator The University of Iowa Iowa City, IA	1984-87
John E. Penick, STS Coordinator Professor of Science Education The University of Iowa Iowa City, IA	1984-87
Alan J. McCormack, Elementary Science Coordinator Professor of Zoology and Science Education University of Wyoming Laramie, WY	1984-87
Robert H. Fronk, Science Application Coordinator Professor and Head of Science Education Florida Institute of Technology Melbourne, FL	1984-87
Willis J. Horak, Middle/Junior High Coordinator Associate Professor of Elementary Education University of Arizona Tucson, AZ	1984-85
Donald W. Humphreys, Gifted and Talented Coordinator Professor of Engineering Temple University Philadelphia, PA	1984-85
Herbert Brunkhorst, STS Coordinator Science Education California State University-Long Beach Long Beach, CA	1986-87

Earl Whitlock, Coordinator 1985-87
Hillsborough County Elementary School
Tampa, FL

Nancy Romance, Coordinator 1985-87
Broward County Schools
Davie, FL

Judy Holtz, STS SESE Teacher 1985-87
Coral Springs Elementary School
Coral Springs, FL

State Science Consultants:

Jack Gerlovich, Iowa 1986-87
Jack Hopper, Florida
LaMar Allred, Utah
William Futrell, Wyoming

Central and Chautauqua Staff:

Mary R. Bucciferro, Graduate Assistant	1984
Sharon Mullin, Research Assistant	1984
Therese Ehrhart	1985
Zoubeida Dagher, Graduate Assistant	1986-87
Paul Tweed, Chautauqua Program Coordinator	1986
David Dawson, Graduate Assistant	1986
Amy Bruner, Graduate Assistant	1986
Douglas Ross, Graduate Assistant	1986-87
Kevin McGreevy, Graduate Assistant	1986-87
Connie Harwood	1984
Linda Tevepaugh, Secretary	1984-85
Carolyn Lewis, Secretary	1986-87
Dora Thompson, Secretary	1987

Adjunct Lecturer Staff Used Summer 1984 and 1985

Michael Babich
Associate Professor of Chemistry
Florida Institute of Technology
Melbourne, FL

Ronald Beiswenger
University of Wyoming
Laramie, WY

Matthew Bruce
Professor of Science Education
Temple University
Philadelphia, PA

Bonnie Brunkhorst
NSTA Middle School Director
The University of Iowa
Iowa City, IA

Rodger W. Bybee
Biological Sciences Curriculum Study
Colorado College
Colorado Springs, CO

Donald Clark
Professor of Education
University of Arizona
Tucson, AZ

David Duvall
Professor of Zoology
University of Wyoming
Laramie, WY

Susan Englert
Department of Physics
University of Wyoming
Laramie, WY

John D. Fix
Professor of Physics & Astronomy
University of Iowa
Iowa City, IA

James J. Gallagher
Michigan State University
College of Education
East Lansing, MI

Eugene Gauron
Professor of Psychology
University of Iowa
Iowa City, IA

Yetta Goodman
Professor of Education
University of Arizona
Tucson, AZ

Robert Hilgenfeld
Computer Education Specialist
University of Wyoming
Laramie, WY

Philip Horton
Associate Professor of
Science Education
Florida Institute of Technology
Melbourne, FL

Paul D. Hurd
549 Hilbar Lane
Palo Alto, CA

Robert James
Professor of Education
Texas A & M University
College Station, TX

Roger T. Johnson
Professor of Science Education
University of Minnesota
Minneapolis, MN

Edward Kalajian
Professor & Head of
Civil Engineering Department
Florida Institute of Technology
Melbourne, FL

David Katz
Professor of Chemistry
University of Arizona
Tucson, AZ

Philip Keller
Professor of Chemistry
University of Arizona
Tucson, AZ

Michael Leyden
Professor of Education
Eastern Illinois University
Normal, IL

Peter Martorella
Director of Curriculum & Instruction
University of North Carolina
Raleigh, NC

James McClurg
Professor of Geology
University of Wyoming
Laramie, WY

Dean Norris
Professor of Oceanography
Florida Institute of Technology
Melbourne, FL

George O'Hearn
Professor and Director
Educational Research and Development
University of Wisconsin
Green Bay, WI

James Okey
Professor of Science Education
University of Georgia
Athens, GA

Terry Oswalt
Assistant Professor of Physics
Florida Institute of Technology
Melbourne, FL

Joseph Piel
Professor of Environmental Eng.
SUNY at Stony Brook
Stony Brook, NY

Charles Polson
Assistant Professor of Biology
Florida Institute of Technology
Melbourne, FL

Harold Pratt
NSSA President and Teacher
Jefferson County Schools
Lakewood, CO

Ranganswam Rajagopal
Professor of Geography
University of Iowa
Iowa City, IA

Andrew Revay
Professor and Dean of Biology
College Science & Engineering
Florida Institute of Technology
Melbourne, FL

John Sainsbury
Professor and Chair of Ocean Eng.
Florida Institute of Technology
Melbourne, FL

Robert Salomon
Professor of Chemistry
Temple University
Philadelphia, PA

Joseph Schmuckler
Professor of Science Education
Temple University
Philadelphia, PA

William Shaw
Professor of Renewable
Natural Resources
University of Arizona
Tucson, AZ

Thomas Smucker
Art Education Specialist
Curriculum and Instruction
University of Wyoming
Laramie, WY

Francis Stasa
Assoc. Professor of Mech. Eng.
Florida Institute of Technology
Melbourne, FL

Joseph Stepans
Professor of Education
University of Wyoming
Laramie, WY

Thomas Stephens
Professor and Head of
Environmental Science Department
Florida Institute of Technology
Melbourne, FL

Harley Thronson
Director of Planetarium and
Professor of Astronomy
University of Wyoming
Laramie, WY

Gene Udell
Professor Emeritus of
Psychology
Science Education
Temple University
Philadelphia, PA

Val Udell
Industrial Communications
Facilitator
Precision Publishing Company
Upper Darby, PA

Alan Voelker
Professor of Science Education
University of Northern Illinois
DeKalb, IL

Frank Webbe
Professor and Dean of School of
School of Psychology
Florida Institute of Technology
Melbourne, FL

John Windsor
Associate Professor of
Physical Oceanography
Florida Institute of Technology
Melbourne, FL

Uri Zoller
Professor of Chemistry
University of Haifa
Oranim Tivon, Israel

APPENDIX IV

SAMPLING OF FEEDBACK QUESTIONNAIRES USED TO ASSESS WORKSHOP IMPACT

PRODUCTS FROM IOWA HONORS WORKSHOP

Name ______________________________ Social Security # ____________

School ______________________________________

School Address ____
(City) (State) (Zip)

Workshop Title ____________________________ Place ______________

Year _______________

Following are the major products that were proposed for each of the 15 workshops that comprised the program. Ideally each participant would have something to report in each category and examples to provide.

1. Workshop Plan

   a. How many workshop plans did you develop? ______

   b. How often were they used, i.e. how many times did you present the workshop? ______

   c. Approximately how many teachers and other professionals were involved with your presentation(s)? ______

   d. Titles of workshops (use the space provided at the end of questionnaire if more than 3 were prepared and used):

      1.

      2.

      3.

   e. Did you collect evaluation/feedback on your workshop plan and its effectiveness? ______

If you have exemplary plans for workshop presentations that can be included in our collection of models for a monograph to be used with NSF officials, NSTA leaders, government leaders, and others, please send them. Also, if you have prepared summaries of evaluations you have completed on such workshop presentations, these would be useful for our reporting and publicizing.

May we expect to receive (either with this questionnaire or under separate cover):

   a. a model workshop plan? ______

   b. an evaluation of the effectiveness of one of the workshops you presented? ______

2. Manuscripts for Publication

a. How many articles describing your model programs have you written? ________

b. How many articles have included evaluation and assessment information have you written? ________

c. How many of these have been published? ________

1. Descriptive ones ________

2. Data based ones ________

d. List article titles and places published or submitted for publication (use space provided at end of questionnaire if more than 3)

1.

2.

3.

If you have additional copies of either type of manuscript that you would like to send for use with NSF, NSTA, and/or government leaders, please include them with this questionnaire or send them under separate cover.

May we expect to receive examples?

a. Published articles? ________

b. Articles submitted for possible publication? ________

c. Reports describing your curriculum? ________

3. Curriculum Materials

a. What was the nature of the curricular materials you developed that are exemplary?

1. Course outline Number: ________

2. Curriculum sequence Number: ________

3. Modules for use within a course Number: ________

4. Special activities Number: ________

b. How many of these were shared with other teachers in the Honors Workshop (from list above)? ________

c. How many of these were shared with other teachers in workshops you conducted? ________

Do we have on file material which describes your model curriculum? ________

Is this information up to date and accurate? ________

Do you have sample curriculum materials that arose in connection with the workshop and/or following activities which we could share with NSF, NSTA, and government leaders? ________

Please provide these materials clearly marked and appended and/or send under separate cover.

What are titles of exemplary curricular materials that you developed? Please use space provided at end of questionnaire for more than 3 examples.

1.

2.

3.

Were your thinking and your original curricular outlines affected by:

If yes, to what degree?

Workshop staff? ______________ ________________________________
Somewhat Greatly Significantly

The total workshop
experience? ______________ ________________________________
Somewhat Greatly Significantly

Other teachers in the summer
workshop? ______________ ________________________________
Somewhat Greatly Significantly

Other teachers encountered in follow-up
workshops you
conducted? ______________ ________________________________
Somewhat Greatly Significantly

4. Instructional Strategies

a. What are some new instructional strategies that you learned from the Honors Workshop staff or from other attending teachers?

1.

2.

3.

b. Were you able to use such new strategies in your own teaching?

c. To what extent?

d. Do you have evidence of impact of specific strategies and/or success of their use in your situation?

Please send information concerning them and their use. Some common strategies considered in many workshops included:

- cooperative learning
- use of community personnel
- focus on community problems
- decision-making
- debate; trial by jury
- student action for problem resolution
- the primary laboratory outside classroom and school
- starting with application/connection

5. Leadership Networks

a. Have you established an even larger and more significant support group for continued growth and greater professional communication as a result of the workshop?

b. How many Honors Workshop participants do you continue to dialogue beyond the workshop per se?

c. Have you formalized a communication network with other leader teachers?

If so, how do these work? What is the precise organization?

Please forward information that can be shared with NSF, NSTA and government leaders.

d. Have you developed new skills with communication, public relations, involving more persons in your teaching and planning?

Please provide whatever examples you can.

e. Have you participated in active plans, state/regional/national improvement efforts? ________

What are some of these?

1.

2.

3.

Use this space for additional responses. Please be sure to number your responses to coincide with the questions.

PERSONAL ASSESSMENT OF IMPACT OF IOWA HONORS WORKSHOP

Name ______________________________ Workshop/Year Attended: _________________________

Has attendance at the Honors Workshop Program influenced you in any of the following areas?

	very positive change	somewhat positive change	no change	somewhat negative change	very negative change
1. My classroom teaching?	1	2	3	4	5
2. My curriculum?					
Content	1	2	3	4	5
Teaching methods	1	2	3	4	5
Use of equipment and materials	1	2	3	4	5
Assessment/evaluation	1	2	3	4	5
3. My relationship with my students?	1	2	3	4	5
4. My attitude toward teaching?	1	2	3	4	5
5. My relationship with my professional peers?	1	2	3	4	5
6. My relationship with my supervisors/administrators?	1	2	3	4	5
7. My relationship as a science educator with my community?	1	2	3	4	5
8. My confidence in myself as a science educator?	1	2	3	4	5

Please provide the following information:

1. What awards have you received since 1983?

   a.

   b.

   c.

2. What are offices to which you have been appointed or elected since 1983?

   a.

   b.

   c.

3. What professional societies do you belong?

a.

b.

c.

d.

4. What presentations have you made since 1983 at professional meetings?

	Presentation Title	Organization
a.		
b.		
c.		
d.		

5. What proposals have you written since 1983? (Indicate with asterisks those which have been funded.)

a.

b.

c.

6. What continuing contacts have you developed with practicing scientists?

	Name	Field	Affiliation
a.			
b.			
c.			
d.			
e.			

Please provide additional information on separate pages if space is too limited for any or all of the above questions.

PERCEPTIONS OF IOWA HONORS WORKSHOP PARTICIPANTS

Name ____________________________ Workshop/Year Attended: ________________________

Please provide information on each of the following products of the Iowa Workshop. Place an "X" on the continuous line for where you were prior to the workshop and a double "XX" where you feel you now are.

1. Ability to plan workshops for other teachers

Not Skilled	Somewhat Skilled	Informed	An Expert

2. Ability to conduct leadership workshops for other teachers

Not Skilled	Somewhat Skilled	Informed	An Expert

3. Ability to prepare descriptive articles for publication

Not Skilled	Somewhat Skilled	Informed	An Expert

4. Ability to prepare manuscripts that include an evaluation component for publication

Not Skilled	Somewhat Skilled	Informed	An Expert

5. Ability to develop new curriculum components

Unskilled	Little Ability	Comfortable	Skilled

6. Ability to evaluate curricular changes

Unskilled	Little Ability	Comfortable	Skilled

7. Ability to identify/describe new teaching approaches

Unskilled	Little Ability	Comfortable	Skilled

8. Ability to try new teaching strategies

Unskilled	Little Ability	Comfortable	Skilled

9. Ability to evaluate use of new teaching strategies

Unskilled	Little Ability	Comfortable	Skilled

10. Ability to interact with other leader teachers

Poor	Fair	Good	Excellent

11. Ability to present and interact at professional meetings

Poor	Fair	Good	Excellent

12. Ability to interact with college science educators

Poor	Fair	Good	Excellent

13. Ability to interact with scientists and engineers

Poor	Fair	Good	Excellent

14. Ability to interact with education research/evaluation experts

Poor	Fair	Good	Excellent

15. Ability to interact with journal editors

Poor	Fair	Good	Excellent

TEACHER INSTRUMENT

PERSPECTIVES ON TEACHING SCIENCE

Name:________________________________ SS#:______________________________

Workshop attended:__________________ Grade level(s) taught:___________

Your name and SS# on this questionnaire will be kept confidential and are necessary for coding purposes. Please note the scale associated with each set of questions.

FOR QUESTIONS 1-9, PLEASE USE THE FOLLOWING SCALE:

Very confident **Moderately Confident** **Not Confident at all**
1___________2____________3____________4_____________5

HOW **CONFIDENT** DO YOU FEEL ABOUT:

1. Following a textbook unit? 1 2 3 4 5
2. Following school and/or curriculum guide? 1 2 3 4 5
3. Identifying a current societal issue related to science and exploring it with your students? 1 2 3 4 5
4. Identifying a current technology issue and exploring it with your students? 1 2 3 4 5
5. Involving students with an issue about which you feel a lack of knowledge? 1 2 3 4 5
6. Involving parents with an issue chosen for classroom consideration about which you feel a lack of knowledge? 1 2 3 4 5
7. Involving community leaders with an issue about which you feel a lack of knowledge? 1 2 3 4 5
8. Involving administrators with an issue about which you feel a lack of knowledge? 1 2 3 4 5
9. Investigating problems/questions that arise unexpectedly? 1 2 3 4 5

Please continue on next page

FOR QUESTIONS 10-13, PLEASE USE THE FOLLOWING SCALE:

Not at all **Sometimes** **Always**
1___________2___________3___________4___________5

HOW OFTEN DO THE FOLLOWING **BOTHER** YOU?

10. Students asking questions that you can't answer? 1 2 3 4 5

11. Being asked to come up with possible explanations for a phenomenon without having done so before? 1 2 3 4 5

12. Being requested to depart from the textbook in your teaching? 1 2 3 4 5

13. Having to create your own teaching activities? 1 2 3 4 5

FOR QUESTIONS 14-20, PLEASE USE THE FOLLOWING SCALE:
Very **Moderately** **Not at all**
1___________2___________3___________4___________5

HOW **COMFORTABLE** ARE YOU IN:

14. Visualizing science as occurring everywhere, i.e. outside class as much as in the class? 1 2 3 4 5

15. Using real world science (outside classroom and textbooks) as a focus for science study? 1 2 3 4 5

16. Dealing with several expert opinions that conflict with each other? 1 2 3 4 5

17. Focusing on activities without necessarily reaching an answer? 1 2 3 4 5

18. Dealing with differing student opinions? 1 2 3 4 5

19. Dealing with other teachers in connection with school-wide projects? 1 2 3 4 5

20. Dealing with controversial topics? 1 2 3 4 5

Please continue on next page

FOR QUESTIONS 21-27, PLEASE USE THE FOLLOWING SCALE:

Strongly Agree	Slightly Agree	Undecided	Slightly Disagree	Strongly Disagree
1	2	3	4	5

21. I enjoy discussing science topics with other teachers. 1 2 3 4 5

22. I believe I have enough background to teach science adequately. 1 2 3 4 5

23. I would like to work with a science consultant to improve my science program. 1 2 3 4 5

24. I prefer teaching science over any other subject. 1 2 3 4 5

25. I would read an issue of Science & Children, Science Scope, or The Science Teacher if they were available in my school. 1 2 3 4 5

26. I would like to work with a teacher to improve my science program. 1 2 3 4 5

27. I would be interested in being a part of an experimental science project. 1 2 3 4 5

Please continue on next page

FOLLOWING IS A LIST OF TOPICS WHICH COULD BE INCLUDED IN A SCHOOL SCIENCE CLASS AS PART OF THE STUDY OF SCIENCE AND TECHNOLOGY IN SOCIETY. INDICATE YOUR CURRENT EMPHASIS ON EACH TOPIC BY MARKING THE APPROPRIATE NUMBER.

High **Low**
1_________2_________3_________4_________5

Topic	Relative emphasis in current course				
Indoor air quality	1	2	3	4	5
Outdoor air quality	1	2	3	4	5
Water quality	1	2	3	4	5
Water supply	1	2	3	4	5
Local news stories	1	2	3	4	5
Acid rain	1	2	3	4	5
Weather modification	1	2	3	4	5
Population	1	2	3	4	5
Noise pollution	1	2	3	4	5
Biomedical advances	1	2	3	4	5
Auto safety	1	2	3	4	5
Pedestrian safety	1	2	3	4	5
Consumer decisions	1	2	3	4	5
Health technology	1	2	3	4	5
Food processing	1	2	3	4	5
Personal health decisions	1	2	3	4	5
Computer applications in society	1	2	3	4	5
Energy use in home/car/recreation	1	2	3	4	5
Effective land use	1	2	3	4	5
The space program	1	2	3	4	5
Spaceship earth	1	2	3	4	5
Solid waste problems	1	2	3	4	5
Diseases	1	2	3	4	5
The space program	1	2	3	4	5
Soil conservation	1	2	3	4	5
Endangered species	1	2	3	4	5
Animal rights	1	2	3	4	5
Drug abuse	1	2	3	4	5
Nuclear warfare	1	2	3	4	5
Spaceship earth	1	2	3	4	5

PARTICIPANT'S PROFILE

1. ID number ______________________

2. Gender (please circle the correct letter) M F

3. How many total years of teaching experience do you have?
_______________ (years)

4. What is your major present teaching assignment (subject and level)
subject area
(1) Elemenatry Science
(2) General Science
(3) Physical Science
(4) Earth Science
(5) Life Science
(6) Geology
(7) Physics
(8) Chemistry
(9) Biology
(10) Others (please specify) _________________________

level
(1) Elemematary School
(2) Middle School
(3) High School
(4) College
(5) Other (please specify)

5. How long have you had this assignment ?__________(years)

6. Major field of study for
bachelor degree _______________
master degree _______________
specialist degree _______________
doctoral degree _______________

7. How many Chautauqua courses have you attended prior to this one ? ______________ (number)

8. How many other science or education related workshops have you attended in the past 5 years ?
__________(number)

9. Are you currently a member of NSTA ? ____________

10. Are you currently a member of local or state science teachers organization ? ________________

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11. How did you find out about this Chautauqua course ?
From
(1) Direct mailing
(2) Science supervisor
(3) School principal
(4) Other teacher
(5) Science coordinator
(6) others (please explain) ______________________________

Teacher Directions for
HOW I FEEL
Primary Version

Preparations

This attitude scale was designed for easy administration by the classroom teacher. It should always be administered by someone who is familiar to, and has good rapport with, the pupils.

The procedures spelled out here duplicate those followed in the other workshop locations. By observing the same procedures, you will insure the validity of the results. **Please follow these directions exactly!**

Before giving this instrument, familiarize yourself with the types of questions asked and the manner in which responses are to be recorded. Make sure that each pupil is supplied with two soft graphite pencils and an eraser.

The classroom should have sufficient light, ventilation, and freedom from noise. Try to avoid locations or times when other students, school bells, or public address system announcements can interfere with concentration.

Scheduling the Tests

The Primary scale is orally administered. The time requirements vary somewhat with groups and the pacing style of the examiner. You should plan five (5) minutes or so for distributing the booklets. The test should be administered in the morning.

Directions and Samples

Read the directions to the students **EXACTLY as they are written.**

Read with a natural tone of voice and in a natural manner.

Read each question twice.

Be sure students know what to do before starting. After directions are read verbatim, they may be further clarified if students do not understand.

Sample items may be reproduced on the chalkboard. They may be discussed or explained in detail. Do **NOT** make up additional sample items.

Move around the room after you have begun to make sure that everyone is working in the correct place, but do not hover over a student. If possible, it would be helpful to have another adult in the room to serve as a helper.

Be sure that everyone is following instructions. Additional instructions may be given to students who seem confused, but do not give a value laden or judgemental answer.

Teacher-made Items

Note: Items 4 and 17 need you to fill in the science topic. Choose two different topics you will be teaching across this school year. Do not choose topics you have already taught or begun to teach. Make sure they are not topics mentioned in any of the other items (i.e., you would not use magnets because Item 8 asks about magnets.) Write on your directions sheet after Item 4 and 17 the topics you have chosen.

Administering the Test

1. As soon as pupils are settled and ready to begin work, say,

> **Today we are going to do some worksheets with questions about how you feel.**

2. Distribute the booklets systematically, making sure pupils receive their own answer sheets.

3. As soon as the tests are distributed, say,

> **Before we begin, look at the front cover of your booklet. See the place where it says "name". Write your first name only on this line.**

When students are finished, instruct them to fill in "grade", "boy", "girl", and "teacher". For younger children, it may be more appropriate for you to fill in the information. Be sure it is completely filled in before booklets are returned.

Then say to the students,

> **Now we are ready to do the worksheets. These worksheets will tell us how you feel about the things I will be reading to you. There are no right or wrong answers. However you feel about the question is the right answer for you.**
>
> **Now, open your booklets to the first page. It is yellow. On this page are six (6) rows of pictures. Look at the pictures in row one, where you see the star.**
>
> **Put your finger on the first face. This is a happy face and makes you feel good. If you like something, this is the face you choose.**

Now put your finger on the second face. This is a sad face and tells us that you don't like something.

Now put your finger on the third face. This is an undecided face. It can't quite make up its mind. It is the face of someone who doesn't like or dislike something.

(S) Let's try one. How do you feel when someone steals something that belongs to you? (Pause for reply.) **That's right, you don't like it. Which face would you mark?** (Pause for reply.) **Yes, you would mark the sad face. Do that right now. Make a big "X" on that face.** (Check to see that each child is marking the sad face.)

(S) Now we'll try another. Put your finger on the row with the circle. How do you feel when it is your birthday? (Pause for reply.) **Yes, you would like that. Which face would you mark? That's right, the smiling, happy face.**

(S) Let's try one more together. Put your finger on the row of faces with the shape like a moon. How would you feel if I walked around the room twice? (Pause for reply.) **You probably wouldn't have strong feelings about it either way. It wouldn't make you sad and it wouldn't make you happy. Which face would you mark?** (Pause for reply.) **That's right, you'd mark the undecided face.**

Now we're ready to begin. Put your finger on the row of faces with the square.

(1) How do you feel about learning to read? If you like it, mark the face that is smiling. If you do not like it, mark the face that is frowning. If you're not sure if you like it or not, mark the face that is undecided. How do you feel about learning to read?

(Continue to monitor the children to see if they are following directions. Repeat the sample directions for each item.)

(2) Let's go on to the row of faces with the triangle. How do you feel about learning about the weather? (Repeat general directions. Remember to read the questions twice.)

(3) Now put your finger on the row with the squiggly lines. How do you feel about learning about numbers?

(4) Now turn the page. The next page is green. Put your finger on the top row, the one with the star. How do you feel about learning about (....teacher inserts word....)?

(5) Now put your finger on the row with the circle. How do you feel about learning about plants?

(6) Now put your finger on the row with the moon. How do you feel about learning about animals?

(7) Put your finger on the row with the square. How do you feel about reading a book about electricity?

(8) Put your finger on the row with the triangle. How do you feel about doing something with magnets?

(9) Put your finger on the row with the squiggly lines. How do you feel about learning about the sky?

(10) **WHAT A GOOD JOB EVERYONE IS DOING. YOU ARE ALL SO CAREFUL TO FIND THE RIGHT ROW OF FACES!!** Now turn to the blue page and put your finger on the row with the star. How do you feel about reading a book about dinosaurs?

(11) Put your finger on the row with the circle. How do feel about being a scientist?

(12) Put your finger on the row with the moon. How do you feel about learning about animals?

(13) Put your finger on the row with the square. How do you feel about doing something with plants?

(14) Put your finger on the row with the triangle. How do you feel about reading a book about witches?

(15) Put your finger on the row with the squiggly lines. How do you feel about being a police officer?

(16) **WE WILL BE DONE SOON NOW. YOU ARE ALL SUCH CAREFUL LISTENERS!** Now turn to the next page. Who can tell us what color it is? (Pause for reply.) Put your finger on the row with the star. How do you feel about doing something with rocks?

(17) Put your finger on the row with the circle. How do you about doing something with (teacher inserts word)?

(18) Put your finger on the row with the moon. How do you feel about being a teacher?

(19) Put your finger on the row with the square. How do you feel about getting a gift?

(20) Put your finger on the row with the triangle. How do you feel about reading a book about space ships?

(21) Put your finger on the row with the squiggly lines? How do you feel about being a person who sells shoes?

(22) Turn to the last page. What color is it? (Pause for reply.) Put your finger on the row with the star. How do you feel about learning about science?

(23) Put your finger on the row with the circle. How do you feel about trying to find the answer to something?

(24) Put your finger on the row with the moon. How do you feel about being a doctor?

(25) Put your finger on the row with the square. How do you feel about learning about other people?

(26) Put your finger on the row with the triangle. How do you feel about reading a book about aquariums?

(27) Put your finger on the row with the squiggly lines. How do you feel about drawing a picture?

YOU HAVE ALL DONE A SUPER JOB! THANK YOU!

END OF TEST. Collect all answer sheets from the students.

PRE/POST VIDEO TAPED LESSON CODING CATEGORIES

PRE	TEACHER BEHAVIORS	POST
________	1) Lectures	________
________	2) Makes statements	________
________	3) *Asks an input question	________
________	4) *Asks a processing question	________
________	5) *Asks an output question	________
________	6) Answers questions by providing factual information	________
________	7) Redirects student questions to other students	________
________	8) Expresses lack of knowledge	________
________	9) Asks students to elaborate or clarify	________
________	10) Uses, clarifies, or elaborates a student's comment or question	________
	RESOURCES FOR KNOWLEDGE	
________	1) Teacher reference to textbook	________
________	2) Student reference to textbook	________
________	3) Teacher reads from textbook	________
________	4) Student reads from textbook	________
________	5) Teacher reference to current event	________
________	6) Student reference to current event	________
________	7) Student reading from magazine, newspaper, journal	________
________	8) Teacher reading from magazine, newspaper, journal	________
________	9) Extended discussion of current event	________
________	10) Extended discussion of student idea	________
	REFERENCES TO INTERDISCIPLINARY STUDIES	
________	1) Societal applications of science	________
________	2) Technological application of science	________
________	3) Ideas from other subject areas	________
________	Social Studies	________
________	Language Arts	________
________	Geography	________
________	Mathematics	________
________	Industrial Arts	________
________	Other	________
	STUDENTS WORKING AS:	
________	1) Whole class	________
________	2 Small groups same task	________
________	3) Small groups different tasks	________
________	4) Individuals same task	________
________	5) Individuals different task	________
________	6) Other	________

PRE	**MATERIALS USED BY STUDENTS**	**POST**
________	1) None	________
________	2) Manipulable science materials	________
________	3) Books	________
________	4) Workbooks	________
________	5) Newspapers/Journals/Magazines	________
________	6) Own paper, notebooks	________
________	7) Movies or film-strips	________
________	8) Other	________

*Input level = counting, matching, naming, defining, observing, reciting, identifying, recalling.

*Processing level = synthesizing, analyzing, categorizing, explaining, comparing, summarizing, inferring, sequencing, stating causality.

*Output level = applying, imagining, evaluating, predicting, creating, speculating, planning, generalizing.

IOWA HONORS WORKSHOP EVALUATION
PRODUCTS FOR FINAL NSF REPORT

Name ______________________ School ______________________

Home Address ____
Street City State Zip

Workshop and Year Attended ______________________________

WORKSHOP PRESENTATIONS: (Indicate number of times presented in parentheses after each title.)

1. ____________________( ) 2. ____________________( )

3. ____________________( ) 4. ____________________( )

PROFESSIONAL ACTIVITIES: (Convention presentation, committees, offices)

1. ____
2. ____
3. ____
4. ____

WRITING:

Titles of Articles	When submitted and/or published
1.	
2.	
3.	
4.	
5.	

Curriculum Modules/Units/Innovation

1. ____
2. ____
3. ____
4. ____

Return this form to: Robert E. Yager, Science Education Center, The University of Iowa, Iowa City, IA 52242

JUNIOR HIGH/SENIOR HIGH

SECTION A: BACKGROUND INFORMATION

1. **Indicate your sex:**

	(Circle one.)
Male	1
Female	2

2. **Are you:**

	(Circle one.)
White (not of Hispanic origin)	1
Black (not of Hispanic origin)	2
Hispanic	3
American Indian or Alaskan Native	4
Asian or Pacific Islander	5
Other *(please specify* ______________________________ *)*	6

3. **How old are you?** __________

4. **How many years have you taught prior to this school year?** _______

5. **Indicate the number of years you have taught each of the following in any of grades 7-12 prior to this school year.**

If none, check here ☐ and go on to Question 6.

Mathematics, grades 7-12 _______

Science, grades 7-12 _______

6. **Which of the following subjects have you taught *in the last three years?***

If you have not taught mathematics or science in the last three years, check here and go on to Question 7.

MATHEMATICS/COMPUTER SCIENCE	(Circle all that apply.)
Mathematics, grades 7-8	1
Remedial, business, consumer, or general mathematics	2
Pre-algebra	3
Algebra, 1st year	4
Algebra, 2nd year	5
Geometry	6
Calculus, advanced mathematics	7
Computer literacy, programming	8
SCIENCE	
General science	9
Biology, environmental, life sciences	10
Chemistry	11
Physics	12
Physical science	13
Earth/space sciences	14

SECTION B: SCIENCE INSTRUCTION IN YOUR SCHOOL

7. Do you teach in a self-contained classroom, i.e., are you responsible for teaching all or most academic subjects to one class?

(Circle one.)

Yes . . . . 1 *Specify grade level(s)* *then go to Question 8*

No . . . . 2 *→ Go to Question 9*

8. We are interested in knowing how much time your students spend studying various subjects. In a typical week, how many days do you have lessons on each of the following subjects, and how many minutes long is an average lesson? (Please write "0" if you do not teach a particular subject to this class.)

	Number of Days per Week	Approximate Number of Minutes per Day
1. Mathematics		
2. Science		
3. Social studies		
4. Reading		

Go to Question 10

9. For each class period you are currently teaching, indicate the course title and the enrollment by grade. Then indicate the code number from the enclosed blue "List of Course Titles" that best describes the content of each course.

		Number of Students in Class by Grade							
Class	Course Title	7	8	9	10	11	12	Total	Course Code Number
1									
2									
3									
4									
5									
6									
7									
8									

10. Are you currently teaching any course(s) that are outside your major area of certification? If yes, write in the course code number(s) from the blue list.

(Circle one.) **Course Code No.**

Yes . . . . 1 *Please specify:* a. ____________________

No 2

b. ____________________

c. ____________________

List of Course Titles

Subject Area	Code Number	Course Title
Science	101	Life science
	102	Earth science
	103	Physical science
	104	General science, grade 7
	105	General science, grade 8
	106	General science, grade 9
	107	General science, grades 10-12
	108	Biology, 1st year
	109	Chemistry, 1st year
	110	Physics, 1st year
	111	Biology, 2nd year
	112	Chemistry, 2nd year
	113	Physics, 2nd year
	114	Astronomy
	115	Anatomy
	116	Physiology
	117	Zoology
	118	Ecology, environmental science
	119	Other science
Mathematics	201	Mathematics, grade 7
	202	Mathematics, grade 8
	203	General mathematics, grade 9
	204	General mathematics, grades 10-12
	205	Business mathematics
	206	Consumer mathematics
	207	Remedial mathematics
	208	Pre-algebra/introduction to algebra
	209	Algebra, 1st year
	210	Algebra, 2nd year
	211	Geometry
	212	Trigonometry
	213	Probability/statistics
	214	Advanced senior mathematics, not including calculus
	215	Advanced senior mathematics, including some calculus
	216	Calculus
	217	Advanced placement calculus
	218	Other mathematics
Computer Science	301	Computer awareness or literacy
	302	Applications and implications of computers
	303	Introductory computer programming
	304	Advanced computer programming
	305	Advanced placement computer science
	306	Other computer science
Other	401	Social studies, history
	402	English, language arts, reading
	403	Business, vocational education
	404	Foreign languages
	405	Health, physical education
	406	Art, music, drama
	407	Other subject

11. **Are you currently teaching any course(s) that you *do not feel adequately qualified* to teach? If yes, write in the course code number(s) from the blue list.**

(Circle one.) **Course Code No.**

Yes .... 1 *Please specify:* a. ______________________

No 2

b. ______________________

c. ______________________

12. a. **In the last year, have you received any assistance (e.g., curriculum materials, guest speakers, support to attend workshops, etc.) *from private industry?***

(Circle one.)

Yes .... 1 – *Go to Question 12b*

No .... 2 } – *Go to Question 13*

Not sure .... 3 }

b. **Indicate the type(s) of assistance you have received.**

(Circle all that apply.)

Curriculum materials	1
Equipment	2
Guest speakers	3
Travel/stipends to attend professional meetings	4
Teacher awards/scholarships	5
Teacher summer employment	6
Other *(please specify* ______________________ *)*	7

13. **The following factors may affect science instruction *in your school as a whole.* In your opinion, how great a problem is caused by each of the following?**

(Circle one on each line.)

		Serious Problem	Somewhat of a Problem	Not a Significant Problem
a	Belief that science is less important than other subjects	1	2	3
b	Inadequate facilities	1	2	3
c	Insufficient funds for purchasing equipment and supplies	1	2	3
d	Lack of materials for individualizing instruction	1	2	3
e	Insufficient numbers of textbooks	1	2	3
f	Poor quality of textbooks	1	2	3
g	Inadequate access to computers	1	2	3
h	Lack of student interest in science	1	2	3
i	Inadequate student reading abilities	1	2	3
j	Lack of teacher interest in science	1	2	3
k	Teachers inadequately prepared to teach science	1	2	3
l	Student absences	1	2	3
m	Lack of teacher planning time	1	2	3
n	Not enough time to teach science	1	2	3
o	Class sizes too large	1	2	3
p	Difficulty in maintaining discipline	1	2	3
q	Inadequate articulation of instruction across grade levels	1	2	3
r	Inadequate diversity of science electives	1	2	3
s	Low enrollments in science courses	1	2	3

SECTION C: YOUR SCIENCE TEACHING IN A PARTICULAR CLASS

The questions in Sections C and D relate to *your science teaching* in a particular class. Please consult the label on the front of this questionnaire to determine the randomly selected science class for which these questions should be answered.

14. a. What is the title of this course? ______________________________

b. Using the blue "List of Course Titles," indicate the code number that best describes the content of this course.

____

15. a. How many students are there in this class? __________

b. Please indicate the number of students in this class in each race/sex category:

	Male	Female
White (not of Hispanic origin)	______	______
Black (not of Hispanic origin)	______	______
Hispanic	______	______
American Indian or Alaskan Native	______	______
Asian or Pacific Islander	______	______
Other *(please specify* ______________________ *)*	______	______
Total	______	______

Note: The total number of males and females should be the same as the number of students in Question 15a.

16. What is the duration of this course?

	(Circle one.)
Year	1
Semester	2
Quarter	3
Other *(please specify* ______________________ *)*	4

17. Which best describes the content of this course?

	(Circle one.)
General science	1
Biology, life sciences, environmental science	2
Chemistry, physics, physical sciences	3
Earth/space sciences	4
Other *(please specify* ______________________ *)*	5

18. Which of the following best describes the ability makeup of this class? (Comparison should be with the average student in the grade.)

	(Circle one.)
Primarily high ability students	1
Primarily low ability students	2
Primarily average ability students	3
Students of widely differing ability levels	4

19. **On the average, how many minutes of science homework do you expect the typical student in this class to complete each day?**

_______ minutes/day

20. **Are there any professional magazines or journals which you find particularly helpful in teaching science to this class?**

(Circle one.)

Yes	1	*Please specify:*	a. ____________________
No	2		b. ____________________
			c. ____________________

21. **Are you using one or more published textbooks or programs for teaching science to this class?**

(Circle one.)

Yes	1	→ *Go to Question 23*
No	2	→ *Go to Question 22*

22. **Why did you choose not to use a textbook?**

(Circle all that apply.)

I prefer to teach without a textbook	1
I did not like the textbook assigned to this class	2
Available textbooks were not appropriate for this class	3
There were insufficient funds to purchase textbooks	4
Other *(specify* ______________________________ ______________________________*)*	5

Go to Question 28

23. **Indicate the publisher of the *one* textbook/program used most often by the students in this class.**

(Circle one.)

Addison-Wesley	01	Janus	15
Allyn & Bacon	02	Laidlaw Brothers	16
American Book	03	Little, Brown	17
Wm. C. Brown	04	Macmillan	18
College Entrance	05	McGraw Hill	19
Coronado	06	Merrill	20
Follett	07	National Science Program	21
Ginn	08	Prentice Hall	22
Globe	09	Rand McNally	23
Harcourt, Brace, & Jovanovich	10	Saunders	24
Harper & Row	11	Scott, Foresman	25
D. C. Heath	12	Silver Burdett	26
Holt, Rinehart, Winston	13	Wiley	27
Houghton Mifflin	14	Other *(please specify* ________________*)*	28

24. Indicate the title, author, and most recent copyright date of this textbook/program.

Title: ______________________________

Author: ______________________________

Most recent copyright date: ____________

25. Approximately what percentage of the textbook will you "cover" in this course?

	(Circle one.)
Less than 25%	1
25-49%	2
50-74%	3
75-90%	4
More than 90%	5

26. Please give us your opinion about each of the following statements related to the textbook you are using most often in this class.

(Circle one on each line.)

This textbook:	**Strongly Agree**	**Agree**	**No Opinion**	**Disagree**	**Strongly Disagree**
a. Is at an appropriate reading level for most of my students	1	2	3	4	5
b. Is not very interesting to my students	1	2	3	4	5
c. Is unclear and disorganized	1	2	3	4	5
d. Helps develop problem-solving skills	1	2	3	4	5
e. Needs more examples to reinforce concepts	1	2	3	4	5
f. Explains concepts clearly	1	2	3	4	5
g. Provides good suggestions for activities and assignments	1	2	3	4	5
h. Lacks examples of the use of science in daily life	1	2	3	4	5
i. Shows the applications of science in careers	1	2	3	4	5
j. Has high quality supplementary materials	1	2	3	4	5

27. Indicate the persons or groups who helped determine that you would use this particular textbook in this science class.

	(Circle all that apply.)
I did	1
The principal	2
A group of teachers from this school	3
A district-wide textbook adoption committe	4
A state-wide textbook adoption committee	5
Other *(please specify* ______________________________*)*	6

28. If you are using any materials instead of, or in addition to, a published textbook or program, briefly describe below.

____

____

____

29. Do you use calculators in this science class?

	(Circle one.)	
Yes	1	→ *Go to Question 30*
No	2	→ *Go to Question 31*

30. How are calculators used in this science class?

	(Circle all that apply.)
Checking answers	1
Doing computations	2
Solving problems	3
Taking tests	4

31. Which best describes the availability of computers (microcomputers or terminals to mini/mainframe) for use with this science class?

	(Circle one.)	
Not available	1	→ *Skip to Question 34*
Available but quite difficult to access	2	
Available but somewhat difficult to access	3	
Readily available	4	

32. How does this science class use computers?
If not used, check here ☐ and skip to Question 34.

	(Circle all that apply.)
Teacher demonstrating computer use	1
Writing programs	2
Learning science content	3
Laboratory tool	4
Drill and practice	5
Using simulations	6
Problem solving	7
Using computer graphics	8
Games	9
Testing and evaluation	10
Other *(please specify* ______________)	11

33. During the *last week* of instruction, how many minutes did a typical student spend working with computers as part of this science class?

	(Circle one.)
None	1
1-14 minutes	2
15-29 minutes	3
30-44 minutes	4
45-60 minutes	5
More than 60 minutes	6

34. Think about your plans for this science class for the entire course. How much emphasis will each of the following *objectives* receive?

(Circle one on each line.)

	None	Minimal Emphasis		Moderate Emphasis		Very Heavy Emphasis
a. Become interested in science	1	2	3	4	5	6
b. Learn basic science concepts	1	2	3	4	5	6
c. Prepare for further study in science	1	2	3	4	5	6
d. Develop inquiry skills	1	2	3	4	5	6
e. Develop a systematic approach to solving problems	1	2	3	4	5	6
f. Learn to effectively communicate ideas in science	1	2	3	4	5	6
g. Become aware of the importance of science in daily life	1	2	3	4	5	6
h. Learn about applications of science in technology	1	2	3	4	5	6
i. Learn about the career relevance of science	1	2	3	4	5	6
j. Learn about the history of science	1	2	3	4	5	6
k. Develop awareness of safety issues in lab	1	2	3	4	5	6
l. Develop skill in lab techniques	1	2	3	4	5	6

SECTION D: YOUR MOST RECENT SCIENCE LESSON IN THIS CLASS

Please answer the following questions specific to *your most recent science lesson* in this class. Do not be concerned if this lesson was not typical of instruction in this class.

35. a. How many minutes were allocated for that science lesson? ______

b. Of these, how many were spent on the following:

Daily routines, interruptions, and other non-instructional activities	______
Lecture	______
Working with hands-on, manipulative, or laboratory materials	______
Reading about science	______
Test or quiz	______
Other science instructional activities	______
Total	______

(Should be the same as Question 35a)

36. Did that lesson take place on the most recent day your school was in session?

(Circle one.)

Yes	1
No	2

37. Indicate the activities that took place during that science lesson.

	(Circle all that apply.)
Lecture	1
Discussion	2
Teacher demonstration	3
Student use of hands-on or laboratory materials	4
Student use of calculators	5
Student use of computers	6
Students working in small groups	7
Students doing seatwork assigned from textbook	8
Students completing supplemental worksheets	9
Assigning homework	10

SECTION E: TEACHER PREPARATION

38. Indicate the degrees you hold. Then indicate your major area of study for each degree using the list of code numbers to the right. Space has been provided for you to enter a code number for a second bachelor's or master's degree. Enter more than one code number on the same line only if you had a double major.

If no degree, check here ☐ and go on to Question 39.

Degree	(Circle all that apply.)	Specify Major Area Code No.
Associate	1	__________
Bachelor's	2	__________
2nd Bachelor's		__________
Master's	3	__________
2nd Master's		__________
Specialist or 6-year certificate	4	__________
Doctorate	5	__________

MAJOR AREA CODE NUMBERS

EDUCATION

11 Elementary education
12 Middle school education
13 Secondary education
14 Mathematics education
15 Science education
16 Other education

MATHEMATICS/COMPUTER SCIENCE

21 Mathematics
22 Computer science

SCIENCE

31 Biology, environmental, life sciences
32 Chemistry
33 Physics
34 Physical science
35 Earth/space sciences

OTHER DISCIPLINES

41 History, English, foreign language, etc.

39. **Indicate the categories in which you have completed one or more college courses.**

EDUCATION	(Circle all that apply.)
General methods of teaching	1
Methods of teaching elementary school science	2
Methods of teaching middle school science	3
Methods of teaching secondary school science	4
Supervised student teaching	5
Instructional uses of computers	6
Psychology, human development	7
MATHEMATICS/COMPUTER SCIENCE	
College algebra, trigonometry, elementary functions	8
Calculus	9
Differential equations	10
Probability and statistics	11
Computer programming	12
LIFE SCIENCES	
Introductory biology	13
Botany, plant physiology, etc.	14
Cell biology	15
Ecology, environmental science	16
Genetics, evolution	17
Microbiology	18
Physiology	19
Zoology, animal behavior, etc.	20
CHEMISTRY	
General chemistry	21
Analytical chemistry	22
Organic chemistry	23
Physical chemistry	24
Biochemistry	25
PHYSICS	
General physics	26
Electricity and magnetism	27
Heat and thermodynamics	28
Mechanics	29
Modern or nuclear physics	30
Optics	31
EARTH/SPACE SCIENCES	
Astronomy	32
Geology	33
Meteorology	34
Oceanography	35
Physical geography	36
OTHER	
History of science	37
Science and society	38
Engineering	39

40. **For each of the following subject areas, indicate the number of courses you have completed. Count each course you have taken, regardless of whether it was a semester hour, quarter hour, graduate, or undergraduate course. If your transcripts are not available, provide your best estimates.**

Subject Area	**Circle the number of courses you have completed.**								
Life sciences	0	1	2	3	4	5	6	7	≥8
Chemistry	0	1	2	3	4	5	6	7	≥8
Physics/physical science	0	1	2	3	4	5	6	7	≥8
Earth/space sciences	0	1	2	3	4	5	6	7	≥8
Calculus	0	1	2	3	4	5	6	7	≥8
Computer science	0	1	2	3	4	5	6	7	≥8

41. **What type of state teaching certification do you have?**

	(Circle one.)	
Not certified	1	– *Skip to Question 43*
Provisional (lacking some requirements)	2	
Regular, lifetime, or other certification in *any* subject	3	

42. **In which subject areas do you have state teaching certification?**

	(Circle all that apply.)
Elementary education *(please specify grades: ________)*	1
Middle school education *(please specify grades: ________)*	2
General science	3
Biology, environmental, life sciences	4
Earth/space sciences	5
Physical sciences	6
Chemistry	7
Physics	8
Mathematics	9
Computer science	10
Business	11
English, language arts, reading	12
Physical education, health	13
Social studies, history	14
Foreign language	15
Other *(please specify ________________)*	16

SECTION F: IN-SERVICE EDUCATION IN SCIENCE

43. During the *last 12 months*, what is the *total* amount of time you have spent on in-service education in science or the teaching of science? (Include attendance at professional meetings, workshops, and conferences, but do *not* include formal courses for which you received college credit.)

	(Circle one.)	
None	1	– *Skip to Question 45*
Less than 6 hours	2	
6-15 hours	3	
16-35 hours	4	
More than 35 hours	5	

44. What type(s) of support have you received?

	(Circle all that apply.)
None	1
Released time from teaching	2
Travel and/or per diem expenses	3
Stipends	4
Professional growth credits	5
Other (*please specify* ______________________________)	6

45. If an in-service program that interested you were available, how likely would you be to attend if it were offered at the following times?

(Circle one on each line.)

	Not Likely	Somewhat Likely	Very Likely
a. After school	1	2	3
b. Evenings	1	2	3
c. Saturdays	1	2	3
d. Summers	1	2	3
e. Teacher work days	1	2	3

46. In what year did you last take a course *for college credit* in science or the teaching of science? ________

47. Think about a specific science topic that you would find difficult to teach.

a. What is this topic? ____

b. Which would be the *most* useful in helping you to teach that topic?

	(Circle one.)
Learning more about the basic concepts	1
Learning more about applications of those concepts in daily life, technology, and careers	2
Learning more about instructional materials/techniques	3

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48. Suppose you wanted to find out about the research related to a topic (e.g., discovery learning, science anxiety, or sex differences in learning). How likely would you be to use each of the following sources of information?

(Circle one on each line.)

	Not Likely	Somewhat Likely	Very Likely
a. Other teacher(s)	1	2	3
b. Principals	1	2	3
c. Local science specialists/coordinators	1	2	3
d. State Department personnel	1	2	3
e. Consultants	1	2	3
f. College courses	1	2	3
g. In-service programs	1	2	3
h. Meetings of professional organizations	1	2	3
i. Journals	1	2	3
j. Research reviews	1	2	3
k. Newspapers/magazines	1	2	3
l. Television/radio	1	2	3
m. Publishers and sales representatives	1	2	3

49. How adequately prepared do you feel to teach science in a class that includes the following types of children with special needs?

(Circle one on each line.)

	Totally Unprepared	Somewhat Unprepared	Adequately Prepared	Well Prepared	Very Well Prepared
a. Physically handicapped	1	2	3	4	5
b. Mentally retarded	1	2	3	4	5
c. Learning disabled	1	2	3	4	5

50. What training have you received in educating handicapped children in the regular science classroom?

(Circle all that apply.)

None	1
College course(s)	2
In-service workshop(s)	3
Other (*please specify* ______________________________)	4

51. How adequately prepared do you feel to use computers as an instructional tool with your science classes?

(Circle one.)

Totally unprepared	1
Somewhat unprepared	2
Adequately prepared	3
Well prepared	4
Very well prepared	5

52. What training have you received in the *instructional uses* of computers?

(Circle all that apply.)

None	1
College coursework	2
Less than 3 days' in-service education	3
Three or more days' in-service education	4
Self-taught	5
Other (*please specify*)	6

53. To which of the following professional organizations do you currently belong?

If none, check here ☐ and go on to Question 54.

	(Circle all that apply.)
American Association of Physics Teachers	1
American Chemical Society	2
National Association of Biology Teachers	3
National Association of Geology Teachers	4
National Earth Science Teachers Association	5
National Science Teachers Association	6
School Science and Mathematics Association	7
State-level science education organization	8
Association for Computing Machinery	9
Association for Educational Data Systems	10
Mathematical Association of America	11
National Council of Teachers of Mathematics	12
Society of Industrial and Applied Mathematics	13
State-level mathematics education organization	14
American Federation of Teachers	15
National Education Association	16
Other *(please specify)* ______________________________)	17

54. Please give us your opinion about each of the following statements.

(Circle one on each line.)

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
a. I am in favor of differential pay for teachers in shortage areas such as science	1	2	3	4	5
b. Science is a difficult subject for children to learn	1	2	3	4	5
c. Prospective teachers should have to pass competency tests in science	1	2	3	4	5
d. Hands-on science experiences aren't worth the time and expense	1	2	3	4	5
e. I would like an 11-month contract	1	2	3	4	5
f. My principal really does not understand the problems of teaching science	1	2	3	4	5
g. Experienced teachers should be required to pass competency tests in science	1	2	3	4	5
h. I enjoy teaching science	1	2	3	4	5
i. Laboratory-based science classes are more effective than non-laboratory classes	1	2	3	4	5
j. Industry scientists should be allowed to teach in the public schools	1	2	3	4	5
k. I consider myself a "master" science teacher	1	2	3	4	5

55. When did you complete this questionnaire? __________ (Month) __________ (Day) __________ (Year)

THANK YOU FOR YOUR COOPERATION!

WORKSHOP EVALUATION

WORKSHOP ______________________________

WORKSHOP COORDINATOR ________________________________

1. To what extent was your enjoyment and/or productivity at the workshop affected by the following:

	very positively affected		neutral		very negatively affected
classroom set-up/facilities	1	2	3	4	5
availability of equipment for projects	1	2	3	4	5
group size	1	2	3	4	5
scheduling	1	2	3	4	5
interactions with other participants	1	2	3	4	5
interactions with staff	1	2	3	4	5
food	1	2	3	4	5
lodging	1	2	3	4	5
other, please specify (.................)	1	2	3	4	5

2. The following activities were a valuable use of your time:

	always				never
listening to lectures/presentations	1	2	3	4	5
going on field trips	1	2	3	4	5
working on individual projects	1	2	3	4	5
working on team projects	1	2	3	4	5
sharing ideas with peers	1	2	3	4	5
participating in hands-on activities	1	2	3	4	5
socializing	1	2	3	4	5
other, please specify (.................)	1	2	3	4	5

3. How many of the staff

	all	most	some	few	none
treated you as a professional?	1	2	3	4	5
respected you as a person?	1	2	3	4	5
avoided sexist or other discriminatory comments or actions?	1	2	3	4	5

4. How many of those who gave presentations

	all	most	some	few	none
presented a good role model as a science educator?	1	2	3	4	5
demonstrated knowledge of their topic?	1	2	3	4	5
made their topic relevant to your needs?	1	2	3	4	5
showed enthusiasm for their topic?	1	2	3	4	5
presented new ideas?	1	2	3	4	5
were well-organized?	1	2	3	4	5
used appropriate presentation techniques?	1	2	3	4	5

5. The following statements refer to objectives of the workshop. Please evaluate them in two ways.

First, how well did the workshop meet these objectives?			Second, how useful was this information to you?
Very well ... Not at all		The workshop helped me to:	Very useful ... Not useful
1....2....3....4....5	a.	incorporate ideas from the scientific and industrial communities and from science research into my program.	1....2....3....4....5
1....2....3....4....5	b.	identify current issues, goals, and needs of science education.	1....2....3....4....5
1....2....3....4....5	c.	plan and prepare workshop presentations.	1....2....3....4....5
1....2....3....4....5	d.	learn leadership and change strategies.	1....2....3....4....5
1....2....3....4....5	e.	prepare curriculum and instruction modules to enhance my program.	1....2....3....4....5
1....2....3....4....5	f.	develop a professional network.	1....2....3....4....5
1....2....3....4....5	g.	plan ways to disseminate the ideas I developed and collected.	1....2....3....4....5
1....2....3....4....5	h.	learn evaluation and assessment techniques.	1....2....3....4....5
1....2....3....4....5	i.	write grant proposals.	1....2....3....4....5
1....2....3....4....5	j.	identify possible areas of research within my own program.	1....2....3....4....5
1....2....3....4....5	k.	improve my writing skills.	1....2....3....4....5

If there were other aspects of the workshop that you found especially useful or inspirational, please describe.

6. How would you describe the general environment of the workshop?

goal-directed	|____|____|____|____|	non-directed
cooperative	|____|____|____|____|	competitive
organized	|____|____|____|____|	chaotic
beneficial	|____|____|____|____|	waste of time
stimulating	|____|____|____|____|	boring
relaxing	|____|____|____|____|	hectic
cohesive	|____|____|____|____|	cliqueish
friendly	|____|____|____|____|	unfriendly

7. Have you attended other workshops or inservices of this nature?

(Circle one)

Yes....................................1
No.....................................2

8. If yes, how does this workshop compare?

(Circle one)

Much better than others I attended.......1
A little better..........................2
About the same...........................3
A little worse than others...............4
Much worse...............................5

9. Indicate the extent to which you agree or disagree with the following statements.

As a result of this workshop:

	strongly agree				strongly disagree
my level of enthusiasm has increased	1	2	3	4	5
I feel more confident in my ability to be a leader in science education	1	2	3	4	5
my knowledge of science has increased	1	2	3	4	5
I hope to make my community more aware of the goals of science education	1	2	3	4	5
I feel a greater personal responsibility for the future of science education	1	2	3	4	5

10. Additional comments/reactions (use other side if necessary):

Thank you very much!

SCIENCE EDUCATION PROBLEMS AND PROPOSED SOLUTIONS -- 1986

Directions: Please identify the major issues facing the discipline of science education at this mid-point of the 1980's using the left column. On the right side of the sheet briefly outline/list what you recommend as actions to assist with the resolution of these major problems.

A. The major problems in science education at this point in time are:	B. Actions designed to ameliorate/correct the major problems in science education are:
1.	1.
2.	2.
3.	3.
4.	4.

Express the extent of your agreement with each of the following statements by circling one of the numbers, according to the following scale.

1 - strongly agree
2 - agree
3 - slightly agree
4 - slightly disagree
5 - disagree
6 - strongly disagree

1. Most of the talk in a science class should be teacher talk. 1 2 3 4 5 6

2. Remembering information is the student's main job in science class. 1 2 3 4 5 6

3. All students should be doing the same science activity at the same time. 1 2 3 4 5 6

4. All students in a science class should follow the same routine in an activity. 1 2 3 4 5 6

5. If there is a disagreement, the teacher should decide who is right. 1 2 3 4 5 6

6. Most class time should be spent telling the students about science. 1 2 3 4 5 6

7. The students should make most of the decisions in science class. 1 2 3 4 5 6

8. Teachers should speed up students working at a slow pace in science. 1 2 3 4 5 6

9. Demonstrations should be done by students rather than by the science teacher. 1 2 3 4 5 6

10. The teacher should settle all the questions which come up in science class. 1 2 3 4 5 6

11. Students should be permitted to visit socially in a science class. 1 2 3 4 5 6

12. The teacher should decide what is to be learned in science. 1 2 3 4 5 6

13. Students should make decisions about how science class is run. 1 2 3 4 5 6

14. The students should set the pace of science instruction. 1 2 3 4 5 6

15. The student should be able to choose what he wants to learn in science. 1 2 3 4 5 6

16. Most of the talk in a science class should be student talk. 1 2 3 4 5 6

17. Students should be allowed to reveal likes and dislikes in science class. 1 2 3 4 5 6

18. The teacher should make most of the decisions in science class. 1 2 3 4 5 6

19. Students should be involved in science equipment maintenance. 1 2 3 4 5 6

20. The students should have a role in deciding his science grade. 1 2 3 4 5 6

21. The science problems pursued should be determined by the teacher. 1 2 3 4 5 6

22. The teacher should decide what lab materials students will use. 1 2 3 4 5 6

23. Science equipment and supplies should be easy for the students to get. 1 2 3 4 5 6

24. The science class belongs equally to teacher and students. 1 2 3 4 5 6

25. Students should be allowed to work at any pace they desire in science. 1 2 3 4 5 6

26. The student should be able to select lab materials from available resources. 1 2 3 4 5 6

27. Students should be allowed to organize their own time in science class. 1 2 3 4 5 6

28. Science equipment and supplies belong to the students. 1 2 3 4 5 6

29. Students should be allowed to organize their own classroom. 1 2 3 4 5 6

30. Students should be allowed time in science class to talk among themselves. 1 2 3 4 5 6

31. A science teacher should accept new ideas and viewpoints from students. 1 2 3 4 5 6

32. Most science class time should be spent doing things other than listening. 1 2 3 4 5 6

33. Students should do activities which allow them to discover things. 1 2 3 4 5 6

34. Students should feel free to ask any questions during science class. 1 2 3 4 5 6

35. A student should be encouraged to ask questions in science class. 1 2 3 4 5 6

36. Students should talk as much or more than the teacher during science class. 1 2 3 4 5 6

37. Students should have a chance to try their own ways of doing lab work. 1 2 3 4 5 6

38. A student should enjoy the activities of a science class. 1 2 3 4 5 6

39. Students should be told step by step what they are to do in science class. 1 2 3 4 5 6

40. Teacher should set the pace of science instruction. 1 2 3 4 5 6

(Developed by Russell Yeany, Jr.)

Indicate the extent to which you agree or disagree with the following statements. Note that the response scale has changed.

Strongly agree ... Strongly disagree

My science program is supported by:
the principal............................1....2....3....4....5
school board.............................1....2....3....4....5
other teachers...........................1....2....3....4....5
parents..................................1....2....3....4....5
students.................................1....2....3....4....5

In order to have an outstanding science program it is absolutely necessary to have:
administrative involvement...............1....2....3....4....5
administrative support...................1....2....3....4....5
graduate coursework......................1....2....3....4....5
expertise in one's field.................1....2....3....4....5
support from other teachers..............1....2....3....4....5
high level of enthusiasm.................1....2....3....4....5
strong organizational skills.............1....2....3....4....5
leadership ability.......................1....2....3....4....5

I am satisfied with my program
the way it is............................1....2....3....4....5

My opinions on science education are valued
in my school/school district..............1....2....3....4....5

I have a great deal of confidence in my
ability..................................1....2....3....4....5

I frequently share ideas with other
educators................................1....2....3....4....5

My level of enthusiasm is consistently
high.....................................1....2....3....4....5

Frustration is often a significant element
in my job................................1....2....3....4....5

The following are major sources of frustration:

administrative policies..................1....2....3....4....5
student motivation.......................1....2....3....4....5
staff enthusiasm.........................1....2....3....4....5
parent cooperation.......................1....2....3....4....5
lack of time.............................1....2....3....4....5
lack of energy...........................1....2....3....4....5
lack of materials........................1....2....3....4....5
personal responsibilities................1....2....3....4....5

I like creating my own materials..............1....2....3....4....5

My feelings of worth as an educator are affected by the following:

student achievement...........................1....2....3....4....5
peer support..................................1....2....3....4....5
administrative approval.......................1....2....3....4....5
outside recognition...........................1....2....3....4....5

Teachers in my school are encouraged to be innovative..............................1....2....3....4....5

In respect to your career, what would you like to see yourself doing in the future?

	Yes	No
Remain in present position	1	2
Move to a higher grade level	1	2
Get an advanced degree	1	2
Teach other subject areas of interest	1	2
Work in a non-school setting	1	2
Move to an administrative position	1	2
Get more involved in professional organizations	1	2
Become more involved in curriculum development	1	2

Please indicate the extent of your professional activity during the past five years by circling the number that applies.

Membership in professional organizations......................0....1....2-4....5-10....10+
Offices held in professional organizations......................0....1....2-4....5-10....10+
Workshop presentations delivered.....0....1....2-4....5-10....10+
Programs presented...................0....1....2-4....5-10....10+
Curriculum models/materials developed..........................0....1....2-4....5-10....10+
Articles accepted for publication....0....1....2-4....5-10....10+
Grants received......................0....1....2-4....5-10....10+
Service on professional committees or task forces....................0....1....2-4....5-10....10+
Professional awards received.........0....1....2-4....5-10....10+
Professional meetings attended.......0....1....2-4....5-10....10+
Courses taken for professional improvement........................0....1....2-4....5-10....10+
Workshops or inservices attended for professional improvement, but not required by administration.........0....1....2-4....5-10....10+

NAME ______________________________ CURRENT POSITION ________________________

SCHOOL ___________________________

Has attendance at last summer's Honors Workshop Program influenced you in any of the following areas? (Please respond to all appropriate to your position).

		very positive change	somewhat positive change	no change	somewhat negative change	very negative change
I.	My classroom teaching?	1	2	3	4	5
	Briefly explain:					
II.	My curriculum?					
	Content	1	2	3	4	5
	Teaching methods	1	2	3	4	5
	Use of equipment and materials	1	2	3	4	5
	Assessment/evaluation	1	2	3	4	5
	Other ______________________	1	2	3	4	5
	Briefly explain:					
III.	My relationship with my students?	1	2	3	4	5
	Briefly explain:					
IV.	My attitude toward my teaching?	1	2	3	4	5
	Briefly explain:					
V.	My relationship with my professional peers?	1	2	3	4	5
	Briefly explain:					
VI.	My relationship with my supervisors/administrator?	1	2	3	4	5
	Briefly explain:					
VII.	My relationship as a science educator with my community?	1	2	3	4	5
	Briefly explain:					
VIII.	My confidence in myself as a science educator?	1	2	3	4	5
	Briefly explain:					

As you reflect on last summer's experiences, what were the best aspects about the workshop?

What were the worst aspects?

Are there aspects you would like to change?

Are there aspects you would like to repeat (experience again)?

****

The next page contains an activity survey sheet. Please respond to the following questions about your professional activities. (Note: professional activities are defined as activities outside requirements of regular position).

1. Compared to a year ago, my overall activity level has
   ______ increased
   ______ decreased
   ______ remained about the same

2. My activity level is
   ______ about what I would like it to be
   ______ more than I would like it to be
   ______ less than I would like it to be

3. My activity level is influenced primarily by: (mark as many as relevant, either as positive or negative influence)
   pos. neg.
   ___ ___ time to do professional functions outside my regular position
   ___ ___ money
   ___ ___ personal interests/responsibilities
   ___ ___ personal abilities
   ___ ___ administrators/supervisor support
   ___ ___ other -- please explain:

PLEASE USE A SEPARATE PIECE OF PAPER FOR ANY ADDITIONAL COMMENTS, SUGGESTIONS, ETC.
PLEASE FILL OUT THE ATTACHED ACTIVITY SURVEY SHEET.

THANKS!!!!!!!!

SURVEY SHEET
(since last summer or latest report)

NAME ______________________________ HONORS WORKSHOP ATTENDED ________________

1. Number of professional meetings attended: ______________
   Organization (National, Regional, State, Local)

2. Number of workshops presented: _____
   Topic Place # of Participants

3. Number of committees, task forces, and offices held: ________
   (Please list)

4. Number of programs, activities, and curriculum models developed: _________
   (Please list) Completed (yes/no)

5. Number of papers/articles submitted for publication: __________
   (If accepted, please list title, journal, and date published).

6. Interactions with other Honors Workshop participants: _______
   Individual # of Contacts Type

7. Input/interactions with scientists/engineers: __________
   Name/Title Address Purpose

Thanks!

APPENDIX V

SAMPLE COPIES OF HONORS WORKSHOP NEWSLETTER

HONORS WORKSHOP NEWSLETTER
Focus on Excellence

VOL. I No. 1 March 1984

NSF SUPPORT FOR WORKSHOP SERIES FOR TEACHERS OF EXEMPLARY PROGRAMS

On February 1, 1984, the letter from NSF was released awarding a 3-year grant at over one million dollars to support a workshop series and follow-up activities for exceptional teachers. The eligible teachers were those associated with NSTA's Search for Excellence in Science Education (SESE) program and the Presidential Award program also administered by NSTA. Nearly 450 teachers associated with the 1982 and 83 SESE programs and the 1983 Presidential Awards program are eligible for participation and are the recipients of this first newsletter associated with the Iowa NSTA Honors Workshop program. Each year additional teachers of SESE programs and the Presidential Awards recipients will be added to the pool of outstanding teachers eligible for participation.

The grant will provide for travel and subsistence costs and a modest stipend ($150) for the participants selected to attend and participate actively in one of a series of five two-week leadership workshops. The five categories of workshops include:

1) Science in the elementary school, K-6;
2) Science in the middle/junior high school, 6-9;
3) Science as preparation for college and careers in science all levels;
4) Science for application in daily living, all levels;
5) Science/technology/society: a focus for the K-12 curriculum.

All recipients of this newsletter are invited to complete the application form appended if interested in participating in the 1984 summer session. All eligible persons will be considered for the future summers as well if not selected for 1984, or if unavailable for participation during the first summer.

MAJOR WORKSHOP GOALS

The NSF-NSTA Honors Workshop series as conducted at The University of Iowa includes a long series of specific goals. However, the main thrust can be characterized briefly and succinctly. They include: 1) an opportunity to teachers of exemplary programs to be recognized further and to interact with others of similar interests, motivation , and achievement; 2) an opportunity to learn leadership tactics designed to facilitate instruction in workshops, conferences, and institutes (an attempt at getting the teaching models and model materials disseminated to other schools and among others teachers); 3) an opportunity to improve, expand, and polish already exemplary materials for the teacher and schools involved in a given workshop and for dissemination efforts; 4) a means of promoting dialogue, communication, continued evolution of ideas and professional growth; 5) a mechanism for advancing positions, desirable new directions, general teaching and curricular practices.

Many teachers of SESE programs have already become acquainted and involved with others through NSTA conventions, award activities, the Iowa Curriculum Update Conference, and the NSTA Focus on Excellence monograph series. The Honors Workshop will be aimed toward making such acquaintance and professional communication deeper and more effective. The aim is to affect school science through greater publicity, communication, use of models of outstanding materials and practices.

WORKSHOP STAFF

The Workshop Series is directed by Robert E. Yager, Retiring President of NSTA, originator of the Search for Excellence in Science Education program, and long-time coordinator of the Science Education Center at the University of Iowa. Yager's background as a biologist, a science teacher, an administrator, a curriculum developer (implementor, researcher, and director of numerous NSF and other in-service programs for teacher) make him uniquely qualified to head this new NSF project.

Working with Yager on a near full-time basis is Ronald J. Bonnstetter, who will coordinate all aspects of the program. Bonnstetter has a rich teaching experience at the secondary school and college levels. In addition, he was responsible for the study of the teachers of exemplary programs and hence knows more about the workshop participants as individuals than anyone else. Bonnstetter has also been active with in-service activities, teacher education, research projects, and environmental education.

Other full-time staff members include a secretary, Connie Harward, two graduate assistants, and work/study assistants. Future newsletters will include more information concerning these essential staff members as well as regular Center staff who will provide input and assistance and a cadre of scientists and engineers who have agreed to participate and to evaluate written products.

During the 1984 summer session, Science Education staff member Vincent L. Lunetta will assist with some leadership activities as a special consultant. He will head weekly sessions and work with society officers. One of his primary functions will be to facilitate staff and participant input into an organization of a Think-Thank that is in the planning stages.

Each of the five workshops mentioned above and described in more detail below will be headed by a science educator with assistance from one to five scientists and engineers/community leaders. For 1984, all of the associated staff members will be drawn from the University of Iowa. However, in future summers they will be drawn from the host institutions—represented by the institutions for the five workshops.

The elementary workshop will be headed by Alan J. McCormack, University of Wyoming. McCormack has been active in NSTA, serves as editor of NABT's *American Biology Teacher*, is past-president of CESI, and heads the science and mathematics teaching center at Wyoming. He has been active in research, in-service efforts throughout the U.S., and is a popular speaker/lecturer at a variety of professional meetings.

The middle/junior high school workshop will be headed by Willis Horak, University of Arizona. Horak has been an active researcher, writer, teacher educator, and in-service leader. He has taught at all levels elementary through college, and has special interests in curriculum revision and teaching strategies.

The applications workshop will be headed by Robert C. Fronk, Florida Technological University. Fronk is a teacher, an active researcher, frequent consultant in schools, and a contributor to the national moves for learning science through technology.

The college preparation/engineering workshop will be headed by Donald W. Humphreys, Temple University. Humphreys has had a rich teaching background when he was honored as an outstanding secondary teacher; he has been active in Indiana and Pennsylvania as a teacher educator, researcher, curriculum developer, and engineering educator.

The S/T/S workshop will be headed by John E. Penick, University of Iowa. Penick has been active as one of the principal investigator associates with Iowa-UPSTEP, a teacher education program supported by NSF for a 10-year period. He has been involved with several national in-service programs and he edits the NSTA Focus on Excellence series. He has been intimately involved with the evolution of the entire SESE concept. He has written about and researched the S/T/S phenomenon. His work with the S/T/S workshop will be used as a model during 1984 to set the pattern, the tone, and the direction for the entire series.

Future newsletters will carry personal notes on staff members as a regular feature. After all, we are all anxious to get to know each other better as we prepare to work with and learn from one another.

BARTON, THE NSF PROGRAM MANAGER

Alec Barton, long time staff member in science education at NSF, is the staff liaison for the project. Barton will follow the project via the newsletter, periodic reports, and personal conferences with the director and coordinator. In addition, he will receive periodic feedback from participant samples. Barton plans to participate several days during two or more of the workshops scheduled for this summer.

WORKSHOP DEFINITION

During 1984, all workshops associated with the grant will be held on the campus of the University of Iowa Science Education Center. The workshops include the basic five which will be repeated during future summers with different participants and, with the exception of S/T/S on other campuses. The five basic categories and future sites beyond 1984 are 1) elementary science (Wyoming); 2) middle/junior high science (Arizona); 3) application of science (Florida); 4) college/professional preparation (Pennsylvania; and 5) S/T/S (Iowa). For 1984, a special leadership conference will be held for workshop staff and officers and staff associated with the major science education professional societies. Special sessions will also be held to develop a plan for a think-tank program concerned with the future of science education. Associated with all the activities will be the traditional Iowa Curriculum Up-Date Conference for supervisors, key teachers, and science education leaders. Each of these eight workshops will be described in more detail.

ELEMENTARY SCIENCE

This workshop will enroll 30 K-6 teachers from the SESE programs. The focus will be upon the nature of the curricula, instructional techniques employed, and dissemination strategies. Participants will prepare workshop kits (for use in presentations); they will work as part of teams to develop more generic and more transportable curriculum models than any of the exemplary programs may have singly.

MIDDLE/JUNIOR HIGH

This workshop will be much like that described above except it will focus on the early adolescent, the different problems of curriculum and teaching at this level, and the more diverse nature of the exemplary programs.

APPLICATIONS/TECHNOLOGY

This workshop will focus upon ways of defining science more broadly so that more students (and persons in general) can learn science though technology. It will deal with the evidence that technology is more meaningful, more relevant, and more motivating than the ideas/concepts of the traditional disciplines for most students. The focus and products will be similar to the previous workshops. However, the primary focus will be upon the meaning of science/technology and the value of a primary organizer such as science applications.

COLLEGE/PROFESSIONAL PREP/INQUIRY

This workshop will focus upon model programs and approaches for the science prone—those interested in the major ideas, advances, and procedures of the basic science. It will examine the measurement of success and multiple ways of providing meaningful sequences for such special students. The program will be designed to enlarge the view of such "preparation" as well as specific ways of evaluating successes of such efforts.

SCIENCE/TECHNOLOGY/SOCIETY

The workshop will focus upon S/T/S as a realistic, tested, appropriate organizer for K-12 science for all students. It will emphasize the various definitions and examples of S/T/S within the SESE center and within the whole instructional arena. The workshop will be responding to the call for a new definition for school science while providing a way of meeting the NSTA manifesto which calls for required science for every student every day of every school year.

LEADERSHIP DEVELOPMENT

The workshop will be designed to help the workshop staff teams work cooperatively to meet common goals. It will also be used to assist officers and staff of various science teaching societies to "buy into" the Search for Excellence effort, the workshop products, and the expertise of the teacher participants involved with the regular series.

THINK-TANK IN SCIENCE EDUCATION

This special workshop will involve workshop staff members (and participants in the workshop as sounding boards) as a means is sought to establish a first think-tank/futurist group in science education. Paul Brandwein noted science educator, author, researcher, lecturer, and leader, will be heading this effort in cooperation with the central staff.

ACADEMIC YEAR ACTIVITIES

Our goal is to disseminate more information about exemplary programs to get more teachers and leaders from such programs involved as workshop leaders, conference speakers, and convention presenters. We will be anxious to promote the use and involvement of the participants in the 1984 Honors Workshop conference.

We hope to organise special get-togethers in conjunction with regional and national meetings. We will keep the newsletter in motion; hopefully, it will become an important communication link for all associated with SESE and the workshop series.

We will be encouraging publication as well as further development of the curriculum modules, especially these produced from more than one SESE program.

We hope to help with JDRP briefs with the eye to an umbrella NDN proposal to promote even more attention, interest, and excitment in the exemplary programs selected. Participants will be encouraged to gain local support for leadership activities. Obviously this has financial obligations for local schools; we expect to help promote the value, need, and desirability for all in having released time and other expressions of local support.

CURRICULA DISPLAY CENTER

Just as a new feature of NSTA conventions will be Roundtable Discussions for each current focal area of SESE and a continuing curriculum display in the Exhibit Hall, we hope that our curriculatorium in our science education center can becomes a repository for the national models which result from SESE. All programs (and teachers of them) are thereby invited to send sample materials and suggestions for displaying them. We hope to have an impressive display prior to June. In addition, please send any action photos of student activities or other material that could be used for curriculatorium bulletin board displays. We have seven large wall areas just waiting for your program material.

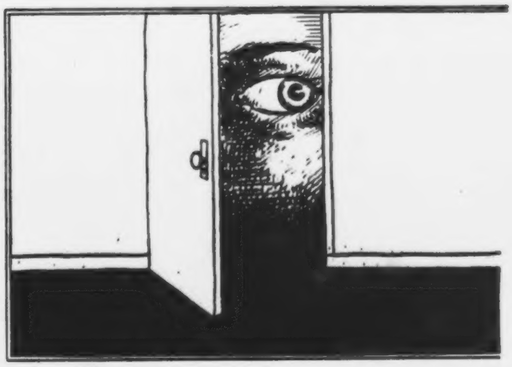
Of course, we are expecting all participants to bring in more examples that will be set up and described as a part of the first day for each workshop. These materials will be used for discussion, modeling, further development, parts of cooperative modules and used in workshop procedures.

You are invited to send materials now or prior to June. In addition, think positively about your involvement in one of the workshops. How can illustration of your national exemplary program be developed for encouraging others to move in similar directions?

VIRGIN ISLANDS SUMMER GET-AWAY FOR EXEMPLARS

Plans for the 1984 Summer Program are taking shape. We already have participants from the far corners of the country with Alaska and Florida both represented. In addition, current airfare rates have allowed the program cost to be reduced $147.00. We are hopeful that the majority of the remaining openings will be filled with representatives of exemplary programs soon after the Boston NSTA Convention. If you or any of your colleagues are interested in joining us, please call or write soon.

Virgin Islands Summer Get-Away
356 Van Allen
University of Iowa
Iowa City, IA 52242 Phone: 319/353-7066



JOIN THE FOCUS ON EXCELLENCE

For more information concerning Honors Workshop, please write:

Honors Workshop
Science Education Center
The University of Iowa
Iowa City, Iowa 52242

or call:

(319) 353-7066

DIRECTOR Robert E. Yager

EDITOR Ronald J. Bonnstetter

NSSA-IOWA CURRICULUM UP-DATE

The workshop is an extension of the NSSA conference that is offered as a means of renewal for science education leaders. Many of the staff from other workshops will be involved; the theme for 1984 will be Focus on Excellence. The NSTA monograph series and the 80 SESE programs will provide a focus. There is a conference fee, unlike other programs in this series, since it is not supported by NSF. It is hoped, however, that if travel support and subsistence is provided for one or two teachers in a given center that others from the same school could also be involved in Up-Date with school and/or personal subsidy. Driving (instead of flying) and cooperative planning can result in more teachers being involved directly for a given summer.

WORKSHOP PRODUCTS

Many "products" of each workshop are likely; perhaps some are not even anticipated at this point. However, the ones described in the initial NSF proposal include the following:

1. A newsletter (of which this is the first attempt by the staff) for communication between workshop staff and participants and professional leaders and among all groups and individuals in each category.
2. Curriculum modules more polished and with ideas from multiple programs so that they can be disseminated more readily to other schools.
3. Workshop, conference, convention plans/features that each participant is ready to use at local, state, regional, and national meetings.
4. Information/schedules concerning conventions, short courses, conferences, and other professional meetings where the participants and their model materials can be used and/or featured.
5. Position statements designed to affect administrators, public officials, other teachers, teacher educators, and other groups, concerning definitions of excellence and needed conditions for achieving it.
6. Plans for continued growth, development, evaluation, communication/dialogues.
7. New involvement, support, input from the scientific, engineering, and community leadership in exemplary science education.

Participant experience, ideas, and expertise will be utilized as resources. The workshops will not be organized as traditional "staff teaching the participants new information/approaches!" Products will be developed cooperatively.

SCHEDULE PRIOR TO JUNE

As mentioned initially in this newsletter, the notification of the grant arrived at the beginning of February. Most of February was spent in establishing the central staff, office facilities, and developing a contact staff. March has resulted in a tentative schedule for all seven workshops described above, arranging program staff consisting of over 75 people, arranging for a scientist/engineer review panel of nearly 100 persons, preparing applicant materials, mailing news releases and sending memoranda to SESE leaders and national leaders, preparing a national brochure, and initiating this newsletter.

We are now ready to process applications and to finalize all plans for the busy summer schedule. We expect to interact with the 52 Presidential Awards recipients at the NSTA meetings in Boston as well as more than 60 teachers and leaders associated with the 30 exemplary programs which will be featured at the Boston meeting. In addition to the Awards Ceremony, a special symposium is planned, several receptions, and three roundtable sessions--one for each focus area for the 1983 search. In addition, we are pleased to note that at least 50 teachers and leaders associated with the 1982 SESE programs will be in Boston. We hope to answer questions, to meet with workshop applicants and would-be applicants, to distribute more application and descriptive materials and to provide more up-to-date planning than is mentioned in the Newsletter.

Applications will be processed by May 1 with initial selections made. We will select 30 teachers for each of the five leadership programs designed for Presidential Awards and SESE teachers. We will encourage others to be involved (with partial expenses provided by the individual or the respective schools) for the Up-Date conference and/or the Think-Tank planning conference.

We expect to complete another Newsletter prior to May 1, and another just prior to the first workshop scheduled for June 10. There will be no other newsletters until the beginning of the 1984 academic year in September.

DAILY FORMAT

Each workshop is planned for a full 14 days. The days will be planned fully with scheduled times for individual participants as well as groups to work on the workshop kits, "hybrid" curriculum modules, position papers, and other workshop products. We know that the teachers of exemplary programs are workaholics and that they would be disappointed if there were not "too much to do--at least to do it all."

Most days will start with a total group session when some national leader will make a presentation and head a discussion. This will usually be followed with a symposium involving three or four other persons--some participants. There will be professional organization representatives, often in charge of sessions and discussions or selected topics/issues. Scientists/ engineers will be asked to react to new directions, to items presented to specific materials. There will be workshops scheduled--usually for 1 1/2 to 2 1/2 hours--dealing with problem-solving, team building, stress, stimulating change. Each day will include three general sessions, one training workshop, a block of time for individuals and group curriculum work, reactant panels, or a special symposium series. There will be breaks for coffee in the morning and afternoon. Lunches and dinner will generally be served in the dormitory facilities. Although some evenings will be open for individual work, there will be frequent evening lectures and/or symposia as well.

As mentioned initially, we are planning a FULL two-week schedule with 14 FULL days!

IOWA HONORS WORKSHOP FOR SESE TEACHERS

Application Form

Name____________________________________ Social Security Number____________

Address:
Home____

____
City State Zip

School____

Position: ____

Telephone ____________________________ ________________________________
Home Office

Previous registration at University of Iowa _____ Yes _____ No

Highest Degree___________ Month & Year Awarded __________________________

Name of Institution_____________________ ____________________ ____________
City State

ACCOMMODATION NEEDS:

NSF funds will support cost of one-half of a double room and all board for two weeks or the equivalent. If double room in dormitory is checked, NSF funds will be used to cover the expenses directly. In all other cases, costs above $75.00 per week must be provided by participant selected. Some persons may be invited if willing to provide for their own subsistence cost.

Dormitory

Double (Board & Room Payed) _____

(Name of roommate preference ____)

Single (Board & Room $232.00 Per Person) _____

We can not guarantee air-conditioned dorm rooms. If a need exists, please make a note on this application.

Iowa House (on-campus hotel)

Private ($35.50/Day) _____ Double ($21.00 each/Day) _____

I would like information on other general facilities

Motel _____ Camping ______ Apartments _____

I would consider attending without NSF support for subsistence. _____ Yes _____ No

Essentially the 1984 offerings include five separate workshops available during three time periods. These include:

June 10-23

Leadership development (for workshop staff & association officials)

1) Science/technology/society _____

June 17-23

curriculum up-date conference ($125.00 fee) _____

June 24-July 7

2) Science in K-6 _____

3) Science in middle/junior high _____

Indicate by number
your first three
preferences in
order.
(1 = 1st choice)

July 8-21

4) Applications for science living _____

5) Science for college preparation _____

Name of administrator approving and encouraging your involvement

______________________________ Title ______________________

Has this person approved your participation in conventions, workshops, and other leadership activities during the 1984-85 academic year? ____ Yes ____ No

On separate pages please respond to the following:

1) Briefly describe the exemplary program you teach and/or supervise. Indicate the nature of both the curriculum and instruction in the last five years.

2) What is the most creative thing you have done in your teaching in the last five years?

3) Why do you want to enroll for the workshop this summer?

4) How do you anticipate using the workshop experiences next year and beyond?

SPECIAL SESE SCHEDULE INCLUDES:

Thursday, April 5

10:00 a.m.-3:00 p.m.	Meetings of SESE Standing Committee.
2:00 p.m.	Set up materials in Exhibit Area (Special SESE section of Curriculum Materials Center).
4:00 p.m.	Reception for 1983 SESE Program Contacts; Teachers from the 30 programs and contacts for the 1982 programs are invited as well.
6:00 p.m.	Meet to rehearse arrangements for Award Ceremony.
6:30 p.m.	Awards Ceremony (opening session and general NSTA awards).
9:00 p.m.	Conversation and Planning. NSF Workshop/ Materials Development Plans; establish other meeting times and places during the convention.

Friday, April 6

1:00-2:15 p.m.	First SESE Roundtable Session involving 10 exemplars from science in non-school settings..
2:30-4:00 p.m.	SESE Symposium (national leaders summarize findings; focus on future) 1982 & 1983 Exemplars invited and may interact after series of presentations.

Saturday, April 7

1:00-2:15 p.m.	Second SESE Roundtable Session involving 10 physics exemplars.

Sunday, April 8

9:00-10:20 a.m.	Third SESE Roundtable Session involving 10 middle/junior high science exemplars.

All SESE teachers are invited to participate in all SESE events; all should asist with roundtable discussions and explanations of Curriculum Materials Center as schedules will permit.

Roundtable Sessions will be informed with representatives for each exemplary program in focus at a table with materials and information on what they do, how they do it, and what is needed to start and to maintain such a program. Some will want to provide handout materials. The room will accommodate 60 persons; however, there is virtually no way to predict the popularity of the sessions. We haven't done it before!

HONORS WORKSHOP NEWSLETTER

Focus on Excellence

VOL. 1 NO. 5 NOVEMBER 1984

HELLO FROM JOAN

I already knew before I started working as Project Coordinator for the Honors Workshop that I had missed all the stimulation, fun, confusion, and hard work of last summer. I have seen a few photographs and they have give me some visual insights.

I am personally looking forward to following up on all your efforts of last summer and plan to provide some feedback to you of the catalytic function (positive, of course) of the program. Please note our continuing request for information and examples of products. Many of you have already responded. We have also included in this newsletter an update information sheeet. I personally know how busy classroom teaching is, but we would like every participant from last summer to find the few minutes that its completion will need.

Since I am new to the Honors Workshop effort, your candid comments, impressions, reactions would be most welcomed. Please write or call (319; 353-7066). We are looking forward to next summer's workshops (see the enclosed schedule). Please look for me at meetings, conferences, etc. Come up and introduce yourself so I may begin to get to know you. Beside, I need more than photos to fill me in on last summer!

A NOTE FROM BRAD SCHOON

Thank you for the materials that have come in thus far. Some of you have expressed confusion as to what kind of "hands-on" activity I'd like you to send me for display in our newly remodelled curriculatorium.

Specifically, we need activities for all grade levels, K-12. The size of our display areas are restricted to the following measurements:

a) For a flat display: 2-3 feet wide, 2.5 feet deep, 1 foot high
b) For a taller display: 2-3 feet wide, 1.5 feet deep, 2 foot high

These activities should be eye catching and attractive in order to highlight/show-off your program; an activity that someone will be drawn to and interested in enough to say, "Hey, this is good! I want to see more of what he/she does!"

We will purchase any relatively inexpensive materials needed for the activity, if they are too bulky to send by mail. Just send me a list of materials needed and a description of how to set up the activity.

I will be anxiously awaiting your response.

1985 HONORS WORKSHOP DATES

The 1985 offerings include five separate workshops available during four time periods in five geographical locations:

July 7-20	1)	Applications of Science Living Florida Institute of Technology, Melbourne
July 14-27	2)	Science for Gifted and Talented Temple University, Philadelphia
July 14-27	3)	Science for Middle/Junior High University Arizona, Tucson
July 21-Aug 3	4)	Science for Technology & Society University of Iowa, Iowa City
August 4-17	5)	Science for K/6 University of Wyoming, Laramie

Other Self-Supporting Experience

June 12-19	1)	Think-tank in science education ($75 fee) University of Iowa, Iowa City
	2)	Curriculum up-date conferences ($125 fee)
June 19-26		a. Exeter, New Hampshire
July 14-19		b. Denver, Colorado
July 8-13		c. Iowa City, Iowa

LEADERSHIP/COORDINATORS MEETING

During the week of January 7, a series of meetings will be held in New Orleans to coordinate future plans for the Honors Workshops. One day will be spent with the Workshop staff and coordinators consolidating dates and agends for various workshops for the summer of 1985. During a second day members of the NSTA SESE Steering Committee will meet to establish a framework for future searches and the Focus on Excellence monograph series. Two days will be spent with representatives of state SESE Chairs and CS^3 (Council of State Science Supervisors) coordinating and discusising plans for specific use of outstanding teachers and their exempalry programs in their repspective states and ways of improving the general operation of state searches for excellence in science education.

1985 HONORS WORKSHOP GOALS

Following is a list of planned outcomes for 150 teacher participants who will be enrolled for the five summer workshops and the follow-up activities planned during the 1985-86 academic year. Alongside each is an indication of timeline and the means for determining whether or not the particular outcome is attained.

1.	A roster of teacher participants with abstracts of their respective exemplary program and an indication of their interest in workshop/ convention presentations and special skills/expertise.	The production of such a roster planned to include all teacher participants in the 1985 series; this roster will be distributed to all persons associated with the 1984 Leadership Conference and all officers of state science teacher associations, state science supervisors and other educational leaders.
2.	Use of teacher participants in state, regional, and national conventions.	Information concerning conference/ convention programs will be collected as a means of verifying the professional involvement of the teacher-participants.
3.	Articles prepared by the teacher participants which describe their innovative programs for others.	The actual collection of articles from each participant (at least one will be anticipated from each of the 150 participants). Attention will be directed to the actual number which are published prior to the end of 1986.
4.	Meetings with subgroups of the teacher participants as well as other evidence of continuing interaction and support.	Information concerning written and in-person contacts among participants will be collected and recorded. Complete success would result if every participant had a personal contact with at least two other participants during the following academic year.
5.	A workshop kit created by each participant for use with other teachers in workshops, staff development programs, in-service projects.	The actual production of such a kit will be noted and evaluated at the close of the summer workshop. Evidence of the use of the kit during the following academic year will illustrate further successs of the effort.

6. New methods for assessing curriculum successes.	The use of such instruments and the reports of their value will be sought. Some of this information will be used in an effort to get more programs included in the NIE National Diffusion Network. It is hoped that at least six new programs can be approved with the use of such assessment instruments.
7. Hybridized curriculum modules where ideas and information from other exemplary programs are added.	The collection of such new plans/materials should illustrate changes, advances, improvements in the programs that originated in a single school with one set of teachers. It is hoped that every one of the exemplary programs will show some changes -- some growth before the end of 1986.
3. The direct involvement of practicing scientists and engineers in the further development of the exemplary programs.	Every teacher participant can report on specific reaction and input of at least two scientists/engineers into the exemplary program as it existed when initially selected by NSTA.
9. New cooperative research projects designed to study and compare exemplary programs and their comparative impact upon students.	Each teacher and school represented will be a part of at least one research/evaluation effort growing out of the workshop experience.
10. Continued input, suggestions, involvement of scientists and engineers in the schools -- with students -- to demonstrate the cooperative nature of the programs and the specific input of practicing scientists and engineers.	A record of the specific input will be maintained, tabulated, and reported. It is hoped that such input can be illustrated with respect to each program.

The main objective is to recognize excellent teaching and programs. In addition, we expect the programs to develop and improve even more with input from the scientific community and other excellent teachers from other exemplary programs. Teachers associated with such programs should be prepared to write about their teaching and their materials, to conduct workshops, and to make presentations of conferences and conventions. Noting such involvement, i.e., articles describing the exemplary programs, workshops planned and conducted, convention appearances, input of scientists, preparation and use of workshop kits, will be evidence of success and impact with the Iowa Honors Workshop.

SESE IN MINNEAPOLIS

by John Penick

The NSTA Regional Meeting in Minneapolis provided many opportunities for teachers from exemplary programs to be recognized, to be heard, and to learn about other exemplary programs.

Eight separate presentations by teachers in exemplary programs or SESE staff members focused on the exemplary programs themselves or generalizations drawn from them. We were particularly gratified by the high attendance at these sessions as compared to many others. Several of them had more than 60 people in attendance. And, equally as rewarding, interest in excellence seem to run high as usual.

Although we heard many comments from teachers indicating they couldn't do what people are doing in exemplary programs, it was hard for them to argue when, in fact, it had been done. This is strong support in favor of curriculum revision leading to outstanding school science programs.

Friday night saw a delightful reception hosted by SESE staff in a suite most graciously donated by NSTA President Alice Moses. More than 100 people gathered to share the wine, cheese, and crackers along with fine conversation (limited, of course, exclusively to discussion of the evolution of outstanding school programs). Later, at the NSTA evening mixer, a few of the teachers from SESE programs did get involved in more standard social endeavors.

But, not all was play in Minneapolis. Seven members of the NSTA SESE Steering Committee met to formlate policy for future searches. At this productive meeting it was decided that initial nomination information be reduced and that program developers be asked to write no more than a page until they have been selected as exemplary.

We are also developing a handbook for state SESE chairs which will provide more direction for state searches and make it easier for all involved.

We are still seeking permanent financial support for SESE as we feel it is a very powerful and positive mechanism for identifying, recognizing, and stimulating excellence in school science programs.

1984 WORKSHOP PARTICIPANTS

Use this newsletter as a vehicle to share what you are doing and what you are thinking with each other. Questions, comments, concerns could be part of an ongoing dialogue. Send in items to Joan or Bob.

Once again, the entire Honors Workshop staff would like to express appreciation to those of you who have responded to our letters and sent us materials for display and other products developed from your involvement last summer. We are in the process of responding to you individually. We know that dedicated teachers like yourselves work long hours practicing your profession. We believe that your past and present efforts to develop better curricula and to share your ideas in workshops and at professional meetings are responsible for many of the advances that have been made in the last few years and will lead to even more improvements in the future!

SUMMARY OF SESE STANDING COMMITTEE MEETING

October 19, 1984
Minneapolis, Minnesota

Seven members of the SESE Committe met for two hours in Minneapolis during the NSTA Area Convention. The following persons were present: Bybee, Johnson, Penick, Dowling, Moses, Clark, Yager.

The first item dealt with the proposal that the initial information sought in the states be greatly reduced -- perhaps no more than a page. The one or two seeming to meet the criteria the best -- perhaps after visitations, telephone contacts, visits with others familiar with the program -- would be invited to meet with the state chair -- or others on the state selection committee -- for help in preparing the extensive application needed for national consideration and for the Focus on Excellence monograph series. This concept of the search feature of SESE was emphasized and reiterated as opposed to the contest feature envisioned by some teachers/schools as well as some state chairs. The search feature was endorsed again as well as the involvement of the state chairs and others in a given state in preparing the application for national recognition; such applications would be "ours" for a given state.

The draft of the CS^3 Handbook for state chairs was discussed. The need for more direction with respect to the state searches and the establishment of criteria of excellence was discussed. The need for specific check points and a calendar was emphasized. Dowling and Yager will work on a new draft for circulation to the CS^3 Executive Board and the entire SESE Committee.

A meeting of the committee, the CS^3 leadership, and selected organizations was announced. Such a meeting is being planned for New Orleans in January. This meeting will be supported by NSF funds -- from the Iowa Honors Workshop. The meeting will be a final attempt at closure on criteria, search areas, the handbook for state chairs, the schedule for Focus Monographs, the search for permanent financial support for SESE.

The prospectus for gaining SESE financial support was reviewed, discussed, and endorsed. Several suggestions for possible personal contacts were elaborated.

The forms for nomination/application of exemplary programs for national recognition were reviewed and endorsed. Programs regarding communication and schedules for 1984 were reviewed.

The group endorsed again the desirability of releasing the monographs at the time of the national convention.

Some considerable time was spent discussing the functioning of the committee as an editorial review board. Problems with using the Special Publications review board after selection and copy has been collected were noted.

Some discussion centered on new committee appointments, new committee chair, and the future.

COMMENTS FROM 1984 PARTICIPANTS

Some evaluative comments from last summer's workshops:

1. What were your expectations for this workshop?
    "to get updated about current trends in science"
    "to share exemplary programs"
    "to get revitalized"

2. Which of your expectations were met?
    "all my expectations were met"
    "I wish I could have shared with the elementary group"
    "needed instruction on creatively writing articles for publication"
    "all and plus"

3. What were the best aspects of the workshop?
    "the people involved -- super group"
    "ideas and hands-on activities"
    "helpful attitude; quality of presentations"
    "interaction with teachers and staff"

4. What were the worst aspects of this workshop?
    "long hours"
    "objectives not clearly stated"
    "organization -- more information should have been mailed stating what to bring and not to bring"
    "time scheduling -- we needed more time to do our own thing"

5. If you were describing this workshop to one of your peers, what would you say in 25 words or less?
    "wow! amazing!"
    "a rare chance to come into contact with teachers who have the same problems and some great solutions"
    "a whole bunch of great science teachers working and learning together"
    "a wonderful professional opportunity to update science research and teaching methods and to learn from top science education professionals and teachers of exemplary programs"

The above comments are taken from Willis Horak's evaluation of the Science in Middle/Junior High Workshop.

HONORS WORKSHOP NEWSLETTER

FOCUS ON EXCELLENCE

VOL 2 NO 3

MAY 1985

THE CINCINNATI CONVENTION

SESE was prominent at the NSTA National Convention. It was a time for recognition of the new exemplars; it was a time for the SESE Committee to meet.

The convention also provided an opportunity for Honors Workshop participants to renew friendships and to continue dialogue. The new exemplary programs were featured (the SESE Roundtable sessions), and materials from many SESE programs were displayed.

All in all, 42 presenters were from SESE programs and the Honors Workshop sessions. The question remains, would such programs have been on the program without SESE and the Honors Workshop efforts??

Presentations at Cincinnati

Many past Honors Workshops participants were actively involved at Cincinnati. These included:

Sharon Bartel
Donald Birdd
James Bodulus
Richard Brinckerhoff
Bonnie Brunkhorst
Herbert Brunkhorst
Michael Demchik
V. Carol Demchik
Joan Hall
Robert Lewis
Mary McCurdy
Beverly McMillan
Kathleen M. Melander
Kathleen Ranwez
Robert Sigda
Kurt (Greg) Smith
Leonard Sparks
James Tomlin

Hope we didn't miss anyone!

Volcano Erupts in Cincinnati

The Life Members' Breakfast was the place to be in Cincinnati, where Donald Birdd came dressed in an animated volcano costume -- flowing lava and all! We wish you could have been there to see it.

TWENTY-FOUR MORE SESE PROGRAMS (AND NEARLY 200 MORE TEACHERS)

Cincinnati resulted in personal meetings for the contact people of the 24 new exemplary programs in chemistry, earth science, and energy education which were announced in October of 1984. Representatives from the eight schools in each of the three categories were recognized at the award ceremony and featured in one symposium. They also highlighted their programs at a Roundtable session and displayed sample materials at an Open-house.

Several personal interactions were far more impressive than the written materials. Nearly 200 teachers associated with the 24 programs are now eligible for the 1985 workshops. In fact, they will be first choice selections!

The 1985-86 SESE Searches

The NSTA SESE Standing Committee deliberated for a long while before approving these new search categories for the 1985-86 effort. The new searches are in the areas of:

1) K-12 S/T/S Revisited
2) K-12 Environmental Studies
3) Pre-Service Teacher Education Secondary

Task forces have been at work for over a year as criteria for excellence have been established. The three task forces listed above were headed by:

STS: David Ost
California State College
9001 Stockdale Highway
Bakersfield, CA 93309

E.S.: Jack Padalino
Pocono Environmental Education Center
Keystone Junior College
Box 268
Dingsman Ferry, PA 18328

P-S S: William C. Ritz
Science Education
California State University
Long Beach, CA 90840

DIRECTORY

A Directory of Workshop Presenters has been completed. We had some with us in Cincinnati, where they were well received. Thanks to all the contributors (who should have received copies by now). Any who have not, should let us know. We are planning a second edition after this summer's series of workshops. If you are not in the first edition and would like to be included in the second edition, complete the workshop data form at the end of this newsletter.

If anyone else can make use of this Directory in planning workshops/ inservice session for teachers, please let Joan know.

GORILLA TRACKS

"What's in a Gorilla?"

"Gorilla" is the name given to our computer data file for the participant activity update information.

Reports from those of you who attended one of last summer's workshops indicate that among yourselves you have written 117 papers, of which 42 have been published, and another 35 currently submitted; you have given 101 workshops (not including Cincinnati!); and over 70 of you have reported curriculum development activity. We are impressed! Do you ever sleep?

Gorilla is Still Hungry

Gorilla is still looking for missing information. Have you sent in the latest activity survey sheet (from the last newsletter)? If not, we have enclosed another. (See end of newsletter).

You should also have received a brief survey form from Bob and Joan asking you to share with us, after a full school year, the impact and impressions of your two weeks last summer.

Gorilla's diet provides us with very important information which demonstrates the extent to which major Honors Workshop goals are being met -- and the ability to impact science education in meaningful ways. LET'S KEEP HIM FED!!

WHAT'S NEW

Field Test Sites for Life Labs

The Life Lab in Santa Cruz is working hard for the dissemination of their programs through California schools. Legislation has already been introduced to fund this dissemination through 1990. Ten schools have already been chosen as field test sites:

School	City or County
Dos Palos	Merced
Happy Valley	Shasta
Hickman	Stanislaus
Henderson	San Joaquin
Mark West/San Miguel	Santa Rosa
Open School	Los Angeles
Piru	Ventura
Robert F. Kennedy	San Jose
Rock Creek	Auburn
Yick Wo	San Francisco

SUMMER 1985 HONORS WORKSHOPS

We have received tremendous response for participation in our workshops this summer. How gratifying this has been, especially from such a well qualified group! However, the workshop coordinators and staff had a difficult task reducing the expressed interest to the limited number of spaces supported by our grant. A special thanks to all those who have applied.

The workshops are now all filled, and unfortunately there was not enough space for many excellent applicants. We hope these individuals will maintain their enthusiasm and apply again next year.

1985 Workshop Products

A major goal of the Honors Workshop Program is to assist participating teachers in the development of their leadership skills. They are then better able to use their expertise to further improve the quality of science education ranging from local to national impact. The following activities and products are some of the desired outcomes:

1. Development of a "workshop kit." This involves the identification of one or more themes around which a workshop-type presentation can be formulated and the establishment of the needed components for actual presentation. Participants will be listed in the Honors Workshop A Directory of Workshop Presenters which is distributed nationally.

2. Continued evolution of science education curriculum. This involvement ranges from the continued growth in one's own classroom teaching to larger scale projects.

3. Writing of articles about different aspects of science education for publication through science education journals and/or Honors Workshop publications.

4. Establishment of linkages with practicing engineers/scientists for the valuable contribution they have to make to curriculum development and career awareness.

5. Identification of research questions to pursue, and particular methods, tools, and collaboration/support systems to use in pursuit.

6. Innovative activities for use in Science Olympiad events.

OTHER EXCITING CONFERENCES

The Iowa Up-Date Conference

An Iowa Curriculum Up-Date Conference has been held at the University of Iowa each year since 1970. The Science Education Center has hosted 20 to 100 participants in a national leaders meeting in which trends were identified and considered, new materials assembled and assessed, centers of excellence identified and studied.

The conferences held for the past seven years have been co-sponsored by the National Science Supervisors Association. This year the new NSSA president, Harold Pratt, Jefferson City Schools, Lakewood, Colorado, will be on hand throughout the conference.

The major topics include:

Gerald Bailey, Kansas State University:
1) Establishing Subject Goals in Relation to School Goals
2) Science Curriculum Design for Change
3) Developing a K-12 Articulated Science Curriculum
4) Constructing Curriculum Guides Teachers Will Use
3) Creating Competencies for Criterion Reference Tests
4) Building Instructional Objectives and Evaluating the Curriculum

Robert K. James, Texas A & M University and Harold Pratt:
1) Overview of the Concerns Based Adoption Model
2) Defining and Measuring Science Teachers' Concerns
3) Using Concerns to Monitor and Manage Implementation
4) Defining the Innovation: Innovation Configuration
5) "When You Get There"
6) Constructing Configuration Checklists and Monitoring Implementation
7) Building a Game Plan for Managing Implementation in Your District

George O'Hearn, University of Wisconsin-Green Bay
1) Establishing an Evaluation Program for K-12 Science
2) Locating and Creating Appropriate Measures for Evaluation
3) Non-Test Techniques and Strategies

Walter S. Smith, University of Kansas
1) Career Awareness in K-12 Science

Materials from SESE programs will be featured in the curriculatorium.

Applications are still being processed. An application form is appended. The cost is $125 plus subsistence. The dates are July 28-August 3.

The Exeter II Conference

Thirty-five key secondary teachers will meet at the Phillips Exeter Academy for a week long conference on June 16-23. Bob Yager is teaming with Dick Brinckerhoff in co-hosting this event -- five years after the first Exeter Conference which was such an important force in reversing the declining support for and interest in science education.

The Klingenstein Foundation and the Dreyfus Foundation are providing some support for the conference and the production of the proceedings of the deliberations. The 35 participants have not been selected. However, the following staff participants and special consultants are set:

Glen S. Aikenhead, University of Saskatchewan
Charles R. Barman, Indiana University, Kokomo
Lloyd Barrow, University of Maine
Ronald J. Bonnstetter, University of Nebraska-Lincoln
Richard Brinckerhoff, Phillips Exeter Academy
Timothy Cooney, University of Northern Iowa
Jon Harkness, Wausau West High School, Wausau, Wisconsin
Art Lebofsky, Clarkstown South High School, West Nyack, New York
Robert Lewis, Hanby Junior High, Wilmington, Delaware
George O'Hearn, Univeristy of Wisconsin-Green Bay
Arthur Powell, Commission on Educational Issues
Harold Pratt, Jefferson County R-2 School District, Lakewood, Colorado
Rustum Roy, Pennyslvania State University
Bassam Z. Shakhashiri, NSF Science Education Director
Morris Shamos, Technican Corporation, New York
Carol Wilson, Dr. Mark T. Sheehan High School, Wallingford, Connecticut
Robert E. Yager, University of Iowa

NOTE FROM JOAN

As this school year draws to a close (and my first six-months as coordinator for the Honors Workshop Program), I must pass on to you how impressed I have been been in meeting, reading about, and "activity-tracking" so many of you. You represent what makes education work: recognition and respect for your students as individuals; enthusiasm for your curricular area/s; and a general love for learning. Fortunately, I met many of you in Cincinnati; unfortunately, there were many more I didn't get to meet. I'll keep trying. Have a refreshing summer!

For More Information on the NSF Honors Workshop Contact:

Honors Workshop
Science Education Center
The University of Iowa
Iowa City, IA 52242
(319) 353-7066

DIRECTOR Robert E. Yager
COORDINATOR Joan B. Tephly
ASST. EDITOR Mary R. Bucciferro

FOCUS
ON
EXCELLENCE

Honors Workshop Newsletter

vol 3 no 1

march 1986

REUNION

RECEPTION

SAN FRANCISCO

HERE WE COME!

FORMER HONORS WORKSHOP PARTICIPANTS and REPRESENTATIVES OF SESE EXEMPLARS. We hope many of you will find it possible to attend the NSTA National Convention, March 25 - 29. Note that we have scheduled a RECEPTION/REUNION. Gerald Skoog, NSTA President, has generously offered us the use of his suite, the Imperial Suite, in the San Francisco Hilton on Wednesday evening, March 26th, 7 - 9 P.M. Hope to see you there!!

A perusal of the preliminary program for the San Francisco Convention finds several of last summer's participants on the program:

> Bonita Talbot, Diana Doepken, Gary Reed, Rick Davis, James E. Bodolus, Marv Mikesh, Linda W. Crow, Clifford L. Schrader, David C. Tucker, Matt Matsumoto, Marylou Rankin, Paula Edwards, Sam S. Chattin, Carole Goshorn, Donna Stump, Bonnie Brunkhorst, Marvin Selnes, Susan Floore, Dave Wiley, Jean Hamlin, JoAnne Wolf, Linda Bostick, Gloria Sternberg, and Kathleen White.

We hope we didn't miss anyone. We also found a number of summer '84 friends in active roles with the convention!

SESE ACTIVITIES IN SAN FRANCISCO

The following are the scheduled activities involved with the Search for Excellence in Science Education.

Wednesday March 26

8-11 A.M.	SESE Committee - Continental Parlor 2, Hilton
1-3 P.M.	Meeting of 1986 Exemplars - Continental Parlor 3, Hilton

Thursday March 27

7-8 A.M.	SESE Breakfast by D. C. Heath - Anza Balboa Room, Hilton
10 A.M.	Organize for Certificate/Plaque presentations - Front of Moscone Center Hall, G-H
10:30-noon	General Session 2 - SESE Awards - Moscone Center Hall, G-H
1:15 P.M.	Elementary Teacher Education Roundtable - Meridien Hotel, Sauternes I
2:30 P.M.	Science & Career Awareness Roundtable - Meridien Hotel, Sauternes I
3:45 P.M.	K-6 Science Roundtable - Meridien Hotel, Sauternes I

Friday March 28

8-10:15 A.M.	Materials Display - Meridien Hotel, Cabernet I
1:15-2:45	SESE Symposium - Sheraton Palace, Golden Gate Room

ACTIVITY REPORT:
1985 HONORS WORKSHOP PARTICIPANTS

We appreciate the time you took away from your busy schedule to fill us in on all the details concerning your recent professional activities. The information you listed on the survey mailed out in January has been entered into the Honors Workshop computer files.

We are pleased to report that of the 155 teacher participants who attended the 1985 Iowa Honors Workshop Program, 61% indicated that they already had found the opportunity to present one or more **workshops**. Many participants, in fact, were quite active in this area, conducting sessions for local school in-service programs, district meetings, and statewide conferences. In addition, twenty-four of Honors Workshop participants will be giving a total of thirty workshop presentations at the National Science Teachers Association Conference in San Francisco later this month.

As of January 15, 1986, a total of over 170 **articles** have been reported. Of this number, 55 have been accepted for publication or are already published, another 57 have been submitted for publication, and over 60 others are reported in draft form. A number of other participants mentioned that they were editing science newsletters.

Many of you are also maintaining **professional communication** with each other. Some type of continuing contact, usually the exchanging of curricular material, was reported by 105 respondents. Seventy-three individuals reported professional contact with over 170 scientists and engineers since the close of last summer's workshops.

As you know, a constantly evolving curriculum is one of the outstanding characteristics of exemplary teachers. **Curriculum development** takes on many forms, from small daily lesson changes to massive state-wide impact efforts. It is gratifying to note that every workshop participant reported curricular impact. In addition, several individuals have written proposals for grant money to support their curriculum dissemination efforts. Five of last summer's teachers are involved with contributions to commercial text services, and many educators are involved with curriculum decisions at the district and/or state level.

OOPS! WE GOOFED!

Our last newsletter listed the SESE Exemplars identified in the 1985 Search for Excellence in Science Education. We goofed in our listing of the K-6 programs. The following programs were not included in our listing and should have been:

Leonard V. Ross Richard J. Mitchell	Turner Elementary- Fresno Unified Schools 5218 E. Clay Fresno, CA 93727	Turner Environmental Science Center
Fred Rundle	Annistown Elementary 3150 Spain Road Lithonia, GA 30084	Integration of Science-A Process Approach with Project Write and the Science Fair
Gary E. Dunkleberger	Carroll Co. Public Schools 55 N. Court Street Westminster, MD 21157	Carroll County Elementary Curriculum Project

QUESTIONS ABOUT CREDIT

Our office has received questions about the graduate credit given to last summer's Honors Workshop participants. PLEASE NOTE!! Everyone attending one of last summer's workshops has received three (3) graduate semester hours of credit from the University of Iowa. Course number and title are: 7S:253 "Recent Curriculum Developments in Science".

The Registrar's office has mailed you an acknowledgement with a grade of "S" (Satisfactory). Some confusion exists because the acknowledgement form also carries the phrase, "Transcripts Not Evaluated". This simply means that you have not been admitted to the Graduate College, no transcripts of previous undergraduate and/or graduate work were requested and hence were not evaluated.

If you need an official transcript with the University seal, there is a $3.00 charge. You should send a check directly to the Registrar requesting the official transcript and indicating your student number (which is your social security number). The address is: Registrar's Office, 1 Jessup Hall, The University of Iowa, Iowa City, Iowa, 52242, phone (319) 353-3756.

We have also received information reporting the receipt of teaching awards, service on committees at various levels (professional, state, district, federal, NSF), election to professional offices, and the responsibility for organization of professional conventions and workshops.

Seventy-one percent of you stated that last summer's workshop had a "significant impact" on your program and your teaching, while 26% reported the workshop resulted in "some impact".

You are a busy group! We applaud you for all your efforts for the development of science education!! Thanks for supplying all that data.

Please Note Correct Addresses:

Home Address:
Bonnie Brunkhorst
4072 Skyline Drive
Ogden, Utah 84403

Professional Address:
Jonas Clarke Junior High School
Lexington, Massachusetts 02173

DIRECTORY OF WORKSHOP PRESENTERS

The Directory of Workshop Presenters 1985-86 has been compiled and is currently in the mail to you. The booklet has also been sent to science supervisors and state science leaders throughout the country. Please inform us if you know of anyone else who would appreciate receiving a copy.

STAFF CHANGES

The spring semester has brought with it some staff changes in the Honors Workshop central office. Our secretary of some time, Linda Tevepaugh, has accepted another position at the University. She is replaced by Carolyn Lewis, who comes to us with considerable experience working with doctors in the medical school. Our graduate assistant for the last year, Mary Bucciferro, is out in that "real world" of student teaching this semester. She is replaced by Tom Richards, a graduate student in Educational Psychology. So when you call you may encounter some new voices on the phone.

NEW DIRECTIONS FOR 1986

This summer will see new directions for the Iowa Honors Workshop Program. We will continue with our primary goal of leadership growth for outstanding science educators. The program will explore models of dissemination in four selected states, (Florida, Utah, Wyoming, and Iowa). Leader teachers in these four target states will attend leadership development workshops early in the summer where they will develop workshop presentations based upon their exemplary programs. The coordinator/state science supervisor in their state will assist them in scheduling presentations later in the summer with teachers who are interested in revising their science education program. Leader teachers will also meet with their workshop participants once or twice across the school year to support implementation in their schools.

While the exploration of state-wide dissemination models focuses on four states for this summer, we hope to include a few representative teachers from other states to establish the nucleus for dissemination efforts in following years. The focus this year will be upon elementary and middle school/junior high programs.

If you are interested in possible involvement in this program, please let Bob Yager or Joan Tephly know.

The 1986 NSSA/Iowa Curriculum Up-Date Conference

The Science Education Center at the University of Iowa has cooperated with NSSA for nearly ten years in offering a summer Curriculum Up-Date Conference for members. This year the conference has been set for July 6-12 on the University campus in Iowa City. Emma Walton joins Merik Aaron, NSSA President, as the NSSA organizer/chair for the annual event.

Bob Yager, NSSA member and long-time coordinator of the Iowa Center and the Conference, is also actively involved with the summer plans.

The theme of the 1986 conference is: Science Education for the Twenty-First Century. Several new initiatives at NSF and the Department of Education will be reviewed; plans/proposals will be developed. New basic definitions of science will be considered; exemplary programs and instructional models will be in focus; issues related with standards, criteria, and evaluation will be emphasized; successful strategies for development, dissemination, and implementation will be reviewed.

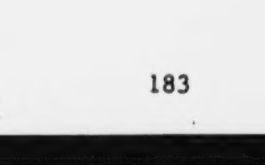
Harold Pratt, NSSA President for 1985-86, will be a featured presenter and analyzer.

In addition to Bob Yager, John Penick, and James Shymansky of the Iowa Center will offer sessions. Other leading science educators are scheduled for sessions. Tentative daily schedules will be available in San Francisco for members interested in applying.

The conference participation will include 2 s.h. of graduate credit and a variety of follow-up cooperative projects and evaluation efforts. The conference fee which includes tuition and instructional costs is $130. Dormitory facilities for board and room are available for those desiring them.

For more information about the 1986 conference, please contact:

NSSA Up-Date Conference
Science Education Center
The University of Iowa
Iowa City, Iowa 52242



backswimmer □

DISSEMINATE YOUR PROGRAM

A federal program exists to assist quality science education programs with dissemination efforts. The National Diffusion Network Division of the Department of Education provides financial support to exemplary programs. To apply for such support, a program must have documentation of its impact (which in most cases means pre- and post-research measures). Many exemplary programs have evolved to their quality status without careful measurement of change.

If you are in the process of new implementation or are introducing your program in new schools/school districts, you are in a position to research this implementation. You need not develop a measurement design on your own. Assistance is available (without charge) from a technical advisory group for prospective submitters of NDN proposals. Contact Dr. Susan Koen, NDN Technical Assistance System, MATRICES Consulting Group, Inc., 4 Eversley Avenue, Norwalk, Connecticut 06851. State facilitators also exist to assist individuals in their states. You can find out your facilitator's name from Dr. Koen or from Joan Tephly in our central office.

PROVE IT

Prove it! A dare we hear from children. But also a dare which undergirds scientific investigation. Science educators also need to prove it. Oh, you may have that gut level feeling of when things go well or do not, or of when you are presenting an improved program to your students. But that gut level feeling is rarely enough to convince others.

NSTA is striving to encourage teachers to become primary evaluators of their programs. Their effort is called "Every Teacher A Researcher". A registry of teachers who are interested in participation in research projects will be established. Teachers can volunteer (without commitment) to be involved in varied research topics. A good introductory article titled "We All Should Be Researchers" by John Butzow and Dorothy Gabel appeared in the January, 1986, issue of The Science Teacher. Watch for more information in this and other NSTA publications. Contact Joan Tephly if you would like more information.

PUBLISHING SUGGESTIONS

From Phyllis Marcuccio, Director of Publications, NSTA,
Marily DeWall, Editor, *Science Scope*, NSTA, and
Karen Reynolds, Field Editor, *Science Scope*, University of California

The following ideas and suggestions were presented by the above three individuals at the NSTA Regional Convention in New Orleans, December, 1985.

Do:

- Include reviews of software or material found effective
- Use clearest, simplest language when writing about research
- Use active, not passive voice
- Write about what you know (If you don't know how to get started, give your prospective article as an assignment to one of your best students)
- Get a colleague to co-author if you're shy
- Present measurements in metric
- Include sense of humor and what is funny in your classroom

Don't:

- Use a very localized topic
- Write about educational research (unless practical application included)

Topics:

- Computers (use to enhance learning)
- Science and reading
- Examples of excellence
- Articles or facilities (change to meet new curriculum demands - lab equipment, layout of rooms)
- Identification of science resources outside of the classroom and their effective use
- How to do it examples
- Evaluation of curriculum techniques and ideas

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Honors Workshop Newsletter

vol 4 no 1

january 1987

1986 PARTICIPANT PLANS, PRODUCTS, ASSESSMENT

We have heard from almost everyone about new projects being carried out through this school year. If you are not in this group, please let us know what you are doing.

Likewise, almost all teachers doing student assessment in their classrooms have completed their preassessments and returned student questionnaires to us for tabulation. Your attention to this aspect of the program is appreciated!! We will be in touch soon about post-assessment. After both pre- and post-assessments have been tabulated we will send you information about responses in your classroom, your state, and the entire group of students using the same instrument(s).

BUSY, BUSY PAST PARTICIPANTS

That's what we said in the last newsletter and it continues to be true. We congratulated Dave Tucker from Washington (STS, 1985) on being a recipient of a Presidential Award. He is not alone. We also congratulate Carol Collins of Tampa, Florida; Chris Gentry of Boise, Idaho; and Dana Van Burgh, Jr. of Casper, Wyoming. They also have been recognized with a Presidential Award. All three attended the Gifted and Talented Honors Workshop in the summer of 1985.

The Life Lab program in Santa Cruz, California, continues to receive acclaim. The New York Times on November 13, 1986, published an article about the program. Gary Appel, Director, and Mark Thomas were involved with the 1984 workshops.

Congratulations are also in order to Eva Kirkpatrick of Imperial, Missouri. In September, 1986, she was the recipient of the 1986 Woman of Achievement Award from the Women in Energy organization. An article featuring the many award-winning science projects her students have developed across the years was featured in the October 31, 1986 issue of Current Science.

We also applaud Ellyn Smith of Hillsborough County, Florida, for her selection as Florida's outstanding elementary science teacher for 1986.

Past Honors Workshop participants were also among those involved with the three NSTA Area Conventions last fall as organizers, office holders, committee members, and presenters.

Indianapolis:

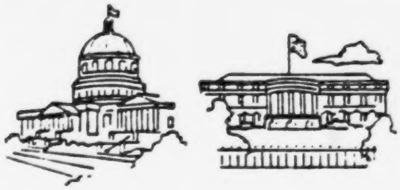
Gil Turpin, William R. Cary, Carole R. Goshorn, Greg Smith, Kathleen Kaye Gulley, Nancy Romance, Sam S. Chattin, Lynn Chattin, Cliff Schrader, L. Neal Carmichael, and Richard F. Brinckerhoff.

Las Vegas:

Robert B. Sigda, Marv Mikesh, Bonita Talbot, Herbert K. Brunkhorst, Bonnie F. Brunkhorst, Sam S. Chattin, Marvin Selnes, Jean Hamlin, JoAnne Wolf, Orwin Draney, and Richard F. Brinckerhoff.

Anchorage:

Emma Walton, Sondra Dexter, Bonnie F. Brunkhorst, Sam S. Chattin, Emily Carpenter, Jean Hamlin, JoAnne Wolf, and Jean Burkus.



HONORS WORKSHOP REUNION

Wing your way to Washington and join us for a few hours of conversation and refreshments with old acquaintances. A reunion for Honors Workshop participants will be held during the NSTA National Convention, March 26-29, 1987. Details will be mailed to you in late February. Hope to see you there. Many remember the fun at a similar occasion—last year in San Francisco!

TRYING TO CALL US...

Well, our telephone numbers have changed at The University of Iowa. Correct phone numbers now are: 319-335-1179, 1178, or 1082.

Did we miss you?? Let us know what you are doing!

NEWS FROM WYOMING

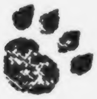
About twenty of the Wyoming participants from the Honors Workshop got together in November in Douglas to continue what was started during the summer. Half of the day was spent in sharing our successes and questions and the other half was spent in inservice training with a professor from the University of Wyoming. All who were there benefited from the renewed fellowship and association with friends made at the summer workshop.

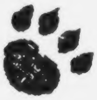
The teachers from Lusk have agreed to host another get-together in the spring. We are optimistic that this may be the start of some on-going communications in Wyoming among elementary teachers who are interested in science education.

The teachers at Douglas Elementary East and staff from the University of Wyoming are hoping to organize a week long workshop for elementary science teachers in the summer of 1987. It is our intention to keep a focus on science education at the elementary school level in Wyoming.

Our best wishes to all other staff members and teachers for a creative and productive year in 1987. We believe that you can make a difference in your school through your involvement.

Bob Pesicka





BROWARD COUNTY NEWS

Five workshop sessions are being conducted in Broward County, Florida, by a team of Broward County elementary educators. The sessions are being held on Saturday mornings across the school year. Three sessions have already taken place. Over forty teachers are attending the series.

At each session teachers are exposed to five different topics. Each member of the team handles a different topic with the teachers rotating to each during the morning. Enthusiasm has been high.

A speaker from NASA was present at the last session. All participating teachers became certified to obtain moon-rocks from NASA. At the next session the teachers will be attending the county science fair. They will be observing and critiquing various projects. Associated seminars will be held by the workshop staff during this session. The last session scheduled for the school year will be an environmental education field trip.

Judy Holtz

HILLSBOROUGH COUNTY NEWS

The NSF Honors Workshop participants have busied themselves with conducting a variety of teacher training sessions since August. To date, the eleven Honors participants have involved 230 K-6th grade teachers a minimum of 15 hours in elementary science. Ten workshops have been offered that focused on giving teachers the confidence to teach laboratory, investigative science. In addition to having some of the training sessions address the local elementary science curriculum, Systems - Balance - Change, sessions were conducted as follows:

> Great Investigation - One Step at a Time: Focused on instruction of science projects in the classroom.
>
> Investigations in Physical Science: Introduced teachers to concepts such as gases, fermentation, and heat, and how to present these through investigation.
>
> CBS through SBC: For teachers new to the gifted science curriculum. Gave background information, practice with equipment, orientation to state standards of excellence in science as well as numerous motivational activities to make the year fun and rewarding.

Teachers involved in the workshops evidenced a great deal of enthusiasm, energy and excitement...for many this evolved from the first session to the last session. There were a few reluctant learners in the beginning. The workshops have been very successful, as reflected in the following comments from participants on leadership:

> "Flexible, interesting, very responsive to individual needs."
>
> "Instructor was very much in tune with our problems offering many suggestions to solve our questions."
>
> "I particularly was impressed with the openness and honesty on the part of the instructors as to what works and what does not work in the classroom and how it might be remedied. I feel better prepared to teach my science classes."
>
> "Very enthusiastic scientists!"

One of the Honors Workshop participants, Ellyn Smith, was selected as the outstanding elementary science teacher in the state for 1986, by the Florida Association of Science Teachers.

Honors participants have also been active giving presentations at state conferences. Ellyn Smith, Patricia Yarnot, Marilyn Blackmer, Lucinda Romano, Sandra Gout, Sandi Schlichting and Bea Green presented at the FAST conference in Tampa. Several presentations are scheduled for January at the Department of Education conference in Daytona. As if this is not enough, many of these energetic science people have been going to other districts to help their teachers and schools get going in active classroom science.

Earl Whitlock

WORKSHOP EVALUATIONS

Evaluations of last summer's workshops again revealed very positive reactions. Participants found their opportunities to interact with both staff and other participants very valuable. Sharing of ideas, participating in hands-on and team activities and listening to presentations were considered valuable aspects of their involvement. They found workshop staff to be very enthusiastic with new and well-organized ideas.

Participants were very positive about their workshop assisting them in identifying current issues, goals and needs of science education, allowing them to develop professional networks, prepare instructional modules, incorporate ideas from the scientific and industrial communities into their programs, and learn leadership, change and dissemination strategies. Almost 100% of the participants reported leaving the workshop with an increased level of enthusiasm, confidence, and personal responsibility for the future of science education and a commitment to carry this sense of responsibility to their own communities.

...but does it last?

Participants from 1984 and 1985 were surveyed again last spring as to their perspectives of their Honors Workshop experience and its impact retrospectively. Nine months to two years later, the following areas of impact received positive rankings from 70 to 95% of the respondents.

Rank ordered from highest:

Improved classroom teaching
Greater confidence as a science educator
Better attitude toward teaching
Improved relationship as science educator with community
Positive change in:
  Teaching methods
  Curriculum content
  Use of equipment and materials
Improved relationship with professional peers
Improved relationship with students, supervisors and administrators

This same group of educators also reported overwhelming continued dedication to further curriculum development and involvement in professional organizations.

If you would like more detailed figures from the workshop or follow-up surveys, let Joan Tephly know.

UTAH AND STS

Close to forty Utah science teachers attended one of two workshops last summer, at Provo or at Ogden. The staff for the two workshops had attended an Honors Workshop in Iowa City in the summer of 1986. Much of their time during this July workshop had been spent putting together the program and format for their August workshops. Their hard work paid off in two well-received workshops.

Science teachers attending the Provo and Ogden workshops have been doing their own researching with their students and will again in the spring be collecting post-assessment information.

We share with you a condensed list developed at the Ogden workshop at Weber State College which is full of many good ways to evaluate students in a STS classroom!

- Group papers (cooperative learning)
- Games
- Cooperative grading (group grade)
- Peer evaluation and grading
- Lab books, notes
- Oral presentations, reports
- Problem solving: given a problem, find a solution (in a regular test situation)
- Contests (points for winning, completion, or placing)
- On-task points (assign task points for period, take away for off-task)
- Self-evaluation, self-grading
- Project design (models, systems)
- Use of scientific method
- Journals, notebooks (most important concept, why? explain)
- Student composed questions
- Value judgments (choose best alternative and why?)
- Subjective efforts
- Critiques
- Vocabulary development
- Visual aid project
- Community improvement projects
- Science fairs
- Discussions
- Individual tests, quizzes (oral, essay, objective)
- Individual classwork-homework
- Concept mapping and application
- Extended work (research, current articles, written projects)

BE IN THE FILMS

Many have expressed interest in videotaping some examples of science teaching in your classroom. This is an excellent opportunity to demonstrate changes you feel you have effected in your classroom in the last one to three years. Most teachers are planning to tape two types of lessons, one which they feel represents their former more traditional way of teaching science and an example reflecting newer innovative approaches currently implemented in the classroom.

We encourage you to get in the films if you are not already. This collection of tapes will provide outstanding demonstrations of quality science education. If you haven't already volunteered to participate, please fill out the attached form and mail it to Joan Tephly, Science Education Center, The University of Iowa, Iowa City, IA 52242.

IOWA CHAUTAUQUA CHALLENGES

The fall Chautauqua Programs were held at four locations in Iowa, beginning with Storm Lake and moving to Decorah, Springbrook, and the Quad Cities. All four of the two-day short courses were very successful and involved 107 teachers from all corners of the state, and a few from neighboring states. The focus of the workshops was upon this major premise: Students of today will be involved with questions that affect our future as guests on this wonderfully rich earth. The question now at hand is: Can there be a way to help our future leaders, future parents, and future consumers learn how to use science in a useful, meaningful way that will encourage people to become active participants in the improvement of our present and future? Yes!! A person can teach in a manner to help our young people gain the confidence that they each make a difference, if they act on what they know. Science classes must move from the regurgitation recipe format to getting students involved with real life. Do something about a locally-relevant issue: toxic chemicals, groundwater pollution, extinction, deforestation, energy, predator control, birth control, population, mining, food production, nuclear issues, agrichemical issues...Any issue can be an interest generator and focal point for learning, understanding, and acting in a beneficial manner towards our home. Studying and acting on these issues also teaches students the so-called basic science concepts and processes.

As an example of teaching science through the study of issues, take the topic of paper. Paper is the most underrated material with which we deal everyday. What can a science class learn from paper? First, we find a problem associated with paper. Here is a surprising bit of information. In the U.S., we throw away one-half of the entire world production of paper--100 billion pounds a year going to the dump! Furthermore, people put the paper in plastic garbage bags! Trees are renewable resources, but when does demand outpace supply? When exploring these questions, new questions will arise, new problems will surface, and the avenues of investigation will mushroom: How is paper made? Where do they make it? What do they use to make it? What kind of trees do they use? Where are the trees grown? What happens to the areas surrounding paper factories? Why do we throw so much away? Where does it go? Why don't we recycle more? What can we do to act and help stop the waste? You can see the potential benefits of a school group asking these questions and looking into the science behind them. Finding solutions involves all the skills associated with science, and the students' attitudes toward science and learning are influenced in a positive manner when they acquire knowledge they need in order to know how to solve problems close to them.

This type of teaching helps a student learn basic skills, decision making, and values by dealing with life, instead of textbooks. Most importantly, a sense of community, pride, and accomplishment, beyond passing test grades, is evident throughout the classroom.

Students learn science content relevant to today's needs. They acquire process skills through doing real investigative science, instead of cookbook labs. Attitudes toward science are more favorable because the students are part of the process, instead of part of the audience.

In the face of today's world situations, doesn't this approach to science make more sense than teaching genetics for the sake of DNA, or the use of the microscope for the use of the microscope? If the students need to know which microorganisms are in the pond to find out whether the pond is polluted, they will need to learn how to use the microscope. As they do, they will be thinking, acting, and becoming more fully human. STS education helps a student become less of a memory machine, more of a living organism, connected to everything, interdependent with all, oblivious to none.

The real challenge presented at the four Chautauqua Short Courses is: Can we help students learn how to learn? Given the proper "tools" students can make a big difference in the future of our state, nation, and globe. It is up to each and every one of us as educators to help our students acquire these tools for better living and on-going learning.

Paul Tweed

GETTING CERTIFIED

The National Science Teachers Association (NSTA) is launching the first national teacher certification program. NSTA is asking elementary through high school teachers to apply for certification after they have completed at least three years of science teaching. The NSTA certification program is based on both educational training and classroom experience.

In the planning stages for the last two years, the NSTA certification program is designed to establish and maintain high standards for science teaching and to identify those teachers who are well qualified to teach science. To become certified by NSTA, teachers must meet specific criteria which vary depending on their grade level: elementary, middle/junior high, or high school. Because they are often specialists, high school teachers are asked to meet additional criteria based on the subject they teach: biology, chemistry, physics, physical science, earth/space science, or general science.

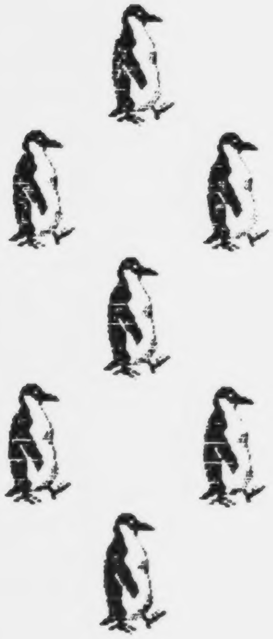
The NSTA certification standards require high school teachers to have the equivalent of a bachelor's degree in one of the sciences and, therefore, match the standards recently recommended by the Carnegie Task Force Report on Teaching as a Profession. The NSTA standards answer the recent call made by U.S. Department of Education Secretary, William J. Bennett, in his report First Lessons by setting forth high standards for elementary school science and by supporting the idea that all science teaching should be a "hands-on adventure in which students learn science by doing science."

"Surveys conducted by NSTA and others have shown that almost one-half of all newly employed science teachers are unqualified and about one-third of all science classes are staffed by unqualified teachers," says Bill G. Aldridge, Executive Director of NSTA and a former physics teacher. "NSTA's rigorous standards are not easy to meet, especially at the elementary level. But at each level they define what teachers need to know to do a good job in preparing their students to live in a scientifically complex world."

Present methods for placing teachers in classrooms, according to Aldridge, often have nothing to do with the training and experience of the individual teacher. This is true especially at the high school level.

Additionally, licensing requirements vary tremendously from state to state. "NSTA recognizes that its standards exceed those of many states," Aldridge says, "but we hope to work with state boards of education to upgrade their standards."

The teacher certification criteria are based on NSTA's standards for science teacher training that were adopted by the Association's Board of Directors in 1985. NSTA's standards have been adopted by the National Council for the Accreditation of Teacher Education (NCATE) and by the Association for the Education of Teachers in Science (AETS). NCATE is using the NSTA standards in deciding whether or not to grant accreditation to teacher training programs in colleges and universities across the nation.



NSTA also plans to offer joint certification with other professional organizations, such as the American Association of Physics Teachers (AAPT).

The application fee is $50. To be certified in a second category, the cost is an additional $25. As part of its new certification program, NSTA promises to stand behind an NSTA-certified teacher who is threatened with being misassigned or with being replaced by an unqualified teacher.

Detailed Standards and Application Forms are available upon request. The address is: NSTA, 1742 Connecticut Avenue, NW, Washington, DC 20009.

IMPACTING STUDENT ATTITUDE

Robert Yager

For many years, we as teachers have focused on only one area of our teaching, "the knowledge domain." Recently, many individuals have discovered the relationships between all five domains in science to be important: Exploring and Discovering (process of science domain), Knowing and Understanding (knowledge domain), Imagining and Creating (creativity domain), Feeling and Valuing (affective domain), Using and Applying (applications and connections domain). Particular emphasis has been placed on the affective (attitudinal) domain. Much research needs to be done to confirm hypothesis stating the importance of this domain. However, the initial results of how STS education contributes to the affective domain look very encouraging.

The analysis of results of the Preferences and Understandings (items released from the National Assessment of Educational Progress) from students enrolled in exemplary science programs has established that progressively more negative attitudes about school science and science teaching can be avoided/halted. When the data have been presented, many have rationalized that negative attitudes can be expected from school experiences in general and science study in particular. It isn't so!

The following tables represent a tabulation of some of the affective information. Please note that three studies of national samples clearly indicate what the typical situation is. However, the results from assessing students enrolled in classes taught by three teachers in a district where NSTA had selected programs at the elementary, junior high, and high school as exemplary are extremely different. (Note: There are very few schools nationally which produce different situations that can boast of exemplary science at all three grade levels!)

PROFESSIONAL MEETINGS
1987

February 6	STS meeting in Washington, DC
February 14-19	AAAS meeting in Chicago, IL
March 19-21	NSSA meeting in St. Louis, MO
March 21-24	ASCD annual meeting in New Orleans, LA
March 26-29	NSTA National Convention in Washington, DC
April 20-24	AERA Annual Meeting in Washington, DC
April 23-25	NARST meeting in Washington, DC
June 25-27	AAPT meeting in Columbus, OH
July 20-24	ICET Assembly in Eindhoven, The Netherlands
August 4-12	Symposium on World Trends in Science and Technology Education in Kiel, Germany
August 20-30	XVI Pacific Science Congress in Seoul, Korea
September 24-26	NSTA Area Convention in Salt Lake City, UT
October 15-17	NSTA Area Convention in Miami Beach, FL
November 5-7	NSTA Area Convention in Pittsburgh, PA
November 19-21	NSTA Area Convention (and CAST) in San Antonio, TX

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march 1987

vol 4 no 2

Honors Workshop Newsletter

REUNION IN WASHINGTON!

All Iowa Honors Workshop participants have been invited to a reunion—probably the last sponsored by the workshop staff—at the NSTA meeting in Washington, D.C. The NSTA staff has recommended Friday evening (7-10 p.m.) for this activity. They have provided space in Room 4300 of the Sheraton Washington Hotel—one of the NSTA headquarter hotels.

The central staff is anxious to see and greet as many participants as possible. Naturally we will be urging you to share more information about the value of such leadership workshops. We are anxious to provide as much and as impressive information/evidence as possible that shows the value of such workshops.

IOWA GOVERNOR HOSTS STATE CONFERENCE DESIGNED TO IMPROVE SCIENCE EDUCATION

On February 25 Governor Terry E. Branstad hosted a conference in Iowa that included state government officials, industrial representatives, leaders from professional societies, science supervisors, scientists/engineers from colleges/universities/industries, and key classroom teachers. A permanent alliance was envisioned for promoting improvement projects and continuous communication among the various alliance groups. Over 200 persons spent an entire day listening to speakers who have been instrumental in establishing such alliances in other states and discussing goals and structure for such an effort in Iowa. All left with positive reaction and great anticipation of the next step for realizing both objectives (i.e. cooperative project and enhanced communication).

ADDITIONAL TEACHERS AFFECTED

During the 1986-87 academic year one of the major differences between the 1986 workshop and the previous ones was the plan to involve another whole tier of teachers in special activities during the 1986-87 academic year. We have amassed all kinds of pre-test information as 474 teachers began efforts with implementing new materials and teaching strategies with students in their schools. Unfortunately the size of this effort has put such a strain on our staff that we have not been able to follow through with questions, assessment instruments, and suggestions as we would have liked.

We do have information on the scope of this academic year's program which is still underway. We have had the following number of teachers and staff involved:

	# Tier II Teachers	Students involved with assessment data
Florida	275	947
Utah	38	674
Wyoming	54	299
Iowa	107	1079

NEW STS GRANT

John Penick has been awarded a new three year grant from NSF to help with STS efforts in Iowa. This effort will expand from the STS efforts already underway as a result of the Honors Workshop.

Sixty teachers from grades 4-9 will be involved in in-depth short courses in applications of biology, chemistry, physics, and earth science for six days during the summer. Twelve STS teachers from past efforts will also be involved sharing their successful experiences. These twelve teachers will remain on campus a second week as specific plans for the academic year's programs are finalized.

Another 60 teachers (colleagues from the same schools as those represented by the 60 teachers in the summer) will be added to the Chautauqua-type courses in the fall. A total of 120 teachers will thereby be involved in introducing STS modules into their 4-9 science programs. Short courses will be held for two days at four sites in Iowa during October. An additional day will be arranged (a Saturday) during the interim. A second two-day workshop will be held in the spring at the same four sites to allow teachers to share the results of their STS experiences. First reports of the modules and evaluation reports with student data will be completed at the end of June—prior to a new cycle for 1988-89.

We all look forward to many challenges of this "Iowa" effort. We'll miss the fine contacts from across the nation that we've enjoyed the past three years.

EVALUATION TO FOCUS ON MULTIPLE DOMAINS FOR SCIENCE EDUCATION

One of the greatest problems in science education is the use of knowledge acquisition as the primary (often only) means of assessing success in science teaching. Although knowledge is important—real knowledge may not be possible until growth in and concern for the other domains occurs.

Alan McCormack structured a taxonomy for five domains. All participants are invited to add categories and examples. All are invited to help locate innovative instruments and/or strategies that can be used to measure growth in these domains.

The domains chart includes:

Domain I - Knowing and Understanding (knowledge domain)

Science aims to categorize the observable universe into manageable units for study and to describe physical and biological relationships. Ultimately, science aims to provide reasonable explanations for observed relationships. Part of any science instruction always involves learning by students to some of the information developed through science.

The Knowing and Understanding Domain includes:

Facts
Information
Concepts
Laws (Principles)
Existing explanations and theories being used by scientists.
Internalized knowledge which can be used

All of this vast amount of information is usually classified into such manageable topics as: matter, energy, motion, animal behavior, plant development.

Domain II - Exploring and Discovering (process of science domain)

How scientists think and work provides another dimension of science. There are specific and definable processes that characterize human actions that result in new knowledge of the universe. Generally these processes are embodied in the terms "exploring and discovering." Some processes of science which can be used in science instruction illustrate goals/outcomes in this domain:

Observing and describing
Classifying and organizing
Measuring and charting
Communicating and understanding communications of others
Predicting and inferring
Hypothesizing
Testing
Identifying and controlling variables
Interpreting data
Constructing instruments, simple devices, and physical models

Domain III - Imagining and Creating (creativity domain)

Most science programs view a science program as something to be done to students to help them learn a given body of information. Little formal attention has been given in science programs to development of students' imagination and creative thinking. Here are some of the human abilities important in this domain:

Visualizing - producing mental images
Combining objects and ideas in new ways
Producing alternate or unusual uses for objects
Solving problems and puzzles
Fantasizing
Pretending
Dreaming
Designing devices and machines
Producing unusual ideas
Identifying
Isolating
Merging
Diverging
Converging

Much research and development has been done on developing students' abilities in this creative domain, but little of this has been purposely incorporated into science programs.

Domain IV - Feeling and Valuing (attitudinal domain)

In these times of increasingly complex social and political institutions, environmental and energy problems, and general worry about the future, scientific content, processes, and even attention to imagination are not sufficient parameters for a science program. Human feelings, values, and decision-making skills need to be addressed. This domain includes:

Developing positive attitudes toward science in general, science in school, and science teachers
Developing positive attitudes toward oneself (an "I can do it" attitude)
Exploring human emotions
Developing sensitivity to, and respect for, the feelings of other people
Expressing personal feelings in a constructive way
Making decisions about personal values
Making decisions about social and environmental issues
Exploring arguments on either side of an issue

Domain V - Using and Applying (applications and connections domain)

It seems pointless to have any science program if the program does not include some substantial amount of information, skills, and attitudes that can be transferred and used in students' everyday lives. Also, it seems inappropriate to divorce "pure" or "academic" science from technology. Students need to become sensitized to those experiences they encounter which reflect ideas they have learned in school science. Some dimensions of this domain are:

Seeing instances of scientific concepts in everyday life experiences
Applying learned science concepts and skills to everyday technological problems
Understanding scientific and technological principles involved in household technological devices
Using scientific processes in solving problems that occur in everyday life
Understanding and evaluating mass media reports of scientific developments
Making decisions related to personal health, nutrition, and life style based on knowledge of scientific concepts rather than on "hear-say" or emotions.
Integrating science with other subjects
Taking specific actions designed to resolve problems and/or to improve a local, regional, national, and/or international problem

Becoming involved in community-action projects; extending school experiences beyond the classroom

Emphasizing the interrelationships and interconnectedness of science to other human enterprises

EMMA WALTON, SONDRA DEXTER STAR IN ANCHORAGE

The NSTA meeting (December 4-6, 1986) in Anchorage, Alaska, was a huge success by any standard! Emma Walton and Sondra Dexter (Honors Workshop participants 1984) were the co-chairs. All kinds of SESE teachers, Honors Workshop participants and staff, and national leaders were on hand.

The Anchorage Times was full of information about the sparkling meeting. One headline story was concerned with research in science education and how such reports informed the public about the current crisis in science education. The report continued, "Two of the nation's leading researchers, Dr. John Penick and Dr. Robert Yager, presented their views concerning the National Assessment of Educational Progress (NAEP) report of the state of science teaching in the U.S.A. The report produced a stinging indictment of current and past practices in science teaching."

The report quoted from NAEP and follow-up assessment of 9,000 students of age 13 and 17 produced a strong and consistent opinion. Over 50 percent of the students believed that their teachers did not take a personal interest in them. Over 79 percent of the students believed that what they learned in their classes had nothing to do with the real world. Students noted that textbooks still dominated the classroom. Over 53 percent of all students surveyed reported that their science classes made them unhappy.

ANCHORAGE HIGHLIGHTS

At the NSTA Area Convention held on December 4-6, 1986, Emma Walton asked what schools can do to turn the crisis around. Some recommendations proposed were:

1. Public school administrators should help science educators lead the way to science reform across the nation by making sure that science programs are socially responsible, relevant, useful, and taught in a personal, humanistic manner. The reorientation will not be an easy task.

2. Public school administrators should be encouraged to attend subject area curricula workshops and conferences in order to help them rethink their philosophical outlook of courses taught in their schools.

3. Collectively, public school administrators responsible for school curriculum and program evaluation should work through their professional organizations to inform curriculum writers and textbook publishers that they expect materials to reflect social responsibility, relevancy, usefulness and a humanistic approach to science education.

4. Last, but not least, we don't need to cut funding in our science programs in favor of other basic areas such as reading and writing. Why? Because research demonstrates that these areas of student cognitive development are significantly increased as well as language development, if experimentation/manipulation is followed by reading, writing and questioning activities.

SUMMARY OF STS ADVANTAGES

The Iowa STS Project permits the following generalizations after three years of effort and the involvement of 240 teachers from grades 4 through 9:

1) Students who experience science in an STS format for a semester or longer acquire as much basic knowledge of science (as measured by standardized and teacher-made examinations) as do students who experience science in a more standard (textbook) way.
2) When teachers stress student experience with a variety of processes of science, students grow in this domain in both the STS and the standard course format.
3) Students who experience science in an STS format are far more positive in terms of their attitudes about science, science classes, science teachers, science careers, and the value of science to themselves; further, these positive attitudes are maintained over several grade levels.
4) STS programs apparently do more to enhance creative thinking than do standard science courses; unfortunately, measurements in the area of creativity are more difficult and there has been little opportunity to study apparent growth over grade levels.
5) Students who experience science as STS can take actions, make decisions, use information, and are more curious than students who experience science primarily as a matter of acquiring certain basic concepts included in typical courses and textbooks.

All participants are encouraged to provide other supporting or conflicting evidence for these generalizations.

THE I.R. SERIES

An Information Report (I.R.) series has been a regular feature of the Iowa Science Education Center for over ten years. The series resulted in only an occasional report after 1976 and the diminution of outside support for science education. The Honors Workshop project resulted in new efforts worthy of such summaries for university officials, leaders of professional societies, and political leaders. The following I.R.s have been produced concerning our Honors Workshop:

#14	1986 Honors Workshop Totals
#15	Iowa Honors Workshop Staff and Participants
#16	The Iowa Honors Workshop: Purposes and Products
#17	Outside Support for Iowa Science Education
#18	The Iowa Chautauqua Project

Copies are available for those participants desiring copies.

PARTICIPANT NEWS

Harold Asmus (1986 Leadership Workshop) will soon have an article published in The Science Teacher.

Bruce MacDonald (1986 Iowa STS Workshop) has written a grant proposal entitled "The Application of Student Team Learning and S.T.S. Design to Elementary Science Education in Lexington." Good luck with this, Bruce!

An interesting article appeared in the January 21, 1987 issue of The Springville Herald regarding Judy Wagner (1986 Utah Honors Workshop) and her science class. The column explained how Judy's enthusiastic young students undergo "hands-on" experiences in the experiments they conduct. Her students can't wait to perform their experiments! Keep up the good work, Judy!

"Non-traditional Earth Science" by David Wiley (Honors Workshop 1984 and STS 1985) appeared in the February/March 1987 issue of Science Scope.

Kathleen Melander (1984 Honors Workshop) presented a workshop entitled, "Thinking and Technology, Success Concept Strategy Workshop" at the Thinking Skills Conference in Nanaimo, British Columbia, November 20-22, 1986.

ANOTHER CHANCE TO PUBLISH

We have funds to print several books that will include the products you have produced. If we can get enough materials in each "product" category, we plan to prepare separate books—rather than to prepare and distribute a few general books with all types of products included.

If you have been negligent in giving us your most recent outline for presenting a workshop, a recent descriptive article concerned with your exemplary program, some assessment/evaluation information concerning your workshop and/or school program, some strategies for instruction and/or in-service efforts—you still have time to get the material to us. We think that these books of workshop products will be impressive evidence of the value of the program, the caliber of the participants, models for others to emulate.

ONE MORE NEWSLETTER

All participants are invited to send news that can be featured in what may be our last Iowa Honors Workshop Newsletter. We are aiming for May 1 as the mailing date.

We hope you will want to let all the other participants know of your most recent thinking and your activities. It would also be great to get some information concerning your plans for the 1987 summer and beyond. We are anxious to do all we can to keep the lines of communication open. Perhaps we all need to work to find new funds and mechanisms for such continuing communication. Let us know your suggestions!

THE IOWA CHAUTAUQUA PROJECT

The National Science Teachers Association developed a Position Statement concerning science education for the 80s which captures the essence of major improvement efforts in schools across the U.S. The statement proclaims:

> The goal of science education during the 1980s is to develop scientifically literate individuals who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday decision-making. The scientifically literate person has a substantial knowledge base of facts, concepts, conceptual networks, and process skills which enable the individual to continue to learn and think logically. This individual both appreciates the value of science and technology in society and understands their limitations.

Many have called efforts to meet this challenge a new direction; many of these efforts have used Science/Technology/Society (STS) as the label that seems to capture the new efforts. Rustum Roy, the director of the largest NSF-supported STS project in the U.S., has called moves to STS to be the megatrend in science education today.

STS programs are designed to produce students who after 13 years of schooling are scientifically and technologically literate. NSTA offers a description of a scientifically literate person; he/she is one who:

1) uses science concepts, process skills, and values in making responsible everyday decisions;
2) understands how society influences science and technology as well as how science and technology influence society;
3) understands that society controls science and technology through the allocation of resources;
4) recognizes the limitations as well as the usefulness of science and technology in advancing human welfare;
5) knows the major concepts, hypotheses, and theories of science and is able to use them;
6) appreciates science and technology for the intellectual stimulus they provide;
7) understands that the generation of scientific knowledge depends upon the inquiry process and upon conceptual theories;
8) distinguishes between scientific evidence and personal opinion;
9) recognizes the origin of science and understands that scientific knowledge is tentative, and subject to change as evidence accumulates;
10) understands the applications of technology and the decisions entailed in the use of technology;
11) has sufficient knowledge and experience to appreciate the worthiness of research and technological development;
12) has a richer and more exciting view of the world as the result of science education; and
13) knows reliable sources of scientific and technological information and uses these sources in the process of decision making.

STS programs are varied and take many different forms. NSTA has conducted two national searches for exemplary STS programs. Some of the major distinguishing factors of such programs include:

1) identification of problem with local interest/impact;
2) use of local resources (human and material) to locate information that can be used in problem resolution;
3) active involvement of students in seeking information that can be used;
4) science teaching going beyond the class period, the classroom, the school;
5) a focus upon personal impact—perhaps starting with student impact—not hoping to get to that level;
6) a view that science content is not something that exists for student mastery simply because it is recorded in print;
7) a de-emphasis upon process skills—just because they represent glamorized skills of practicing scientists
8) a focus upon career awareness—especially careers that students might expect to pursue as they relate to science and technology;
9) students performing in citizenship roles as they attempt to resolve issues they have identified;
10) science study being visible in a school and in a community;
11) science being an experience students are encouraged to learn;
12) science with a focus upon the future and what it may be like.

In Iowa the science education leadership has identified science in grades 4 through 9 as the most critical if improvements for all are to be a reality. STS in such grades seems most desirable since 1) the sequence is for all; 2) most students have developed reading, computational, and study skills; 3) there is much disagreement as to appropriate courses and their sequence; and 4) there is only limited pressure/concern for college preparation (i.e., college entrance scores on standard examinations).

This national focus on STS and the Iowa concern for grades 4 through 9 provide the rationale and focus for the Iowa Chautauqua Project. The project involves 120 teachers from grades 4 through 9 for developing a rationale for STS; committing them to developing and piloting STS modules; forming a network of concerned teachers; sharing trials, frustrations, and successes with each other; collecting evidence of the affects of the STS experience in a variety of domains on the students enrolled.

The Chautauqua plan involves registering 20 to 40 4-9 teachers in two-day fall workshops. The STS rationale and example of previous STS modules for the targeted grades are shared. The enrollees are expected to develop their own modules and to try them with their students after some pre-assessment information is collected. Participants remain in contact with other teachers, the staff, and area supervisors by means of a newsletter, school visits, a one-day interim conference. In the spring a second two-day workshop is held for sharing results of STS trials, evaluative information, and some new insights (from the staff). A final report of the year long project is due June 15.

Each year a fall conference is planned to encourage continuing communication, growth, and sharing. This fall conference involves major state leaders in government, industry, and education. Teachers who have excelled with STS materials and approaches are invited to share their experiences in concurrent sessions. One or more of these teachers are selected to represent the state with all expenses paid at the next NSTA National Convention.

The Iowa Chautauqua Project was initiated as an NSF-supported project administered by NSTA. In 1985 the Iowa Utility Association provided major support for an expanded program. The current program exemplifies the Alliance for Improved Science Education (an alliance of government, industry, and education) as proposed in the 1987 State of the State speech of Governor Terry E. Branstad. The project is headquartered at the Science

Education Center at The University of Iowa; a Chautauqua office has been established.

Each year four sites are selected for the Chautauqua workshop planned. Generally the fall workshops are conducted in October–November—after the annual fall conference. The spring sessions are planned for March–April.

Information concerning the annual program, the fall conference, special evaluation reports, additional sponsorships, sample materials, and application forms can be secured by writing:

The Iowa Chautauqua Program
Science Education Center
The University of Iowa
Iowa City, IA 52242

FOCUS ON EXCELLENCE SERIES

All the following volumes are available from NSTA at $7.00 each:

Special Volumes (not in series)
1. Teachers in Exemplary Programs: How Do They Compare?
2. Centers of Excellence: Portrays of Six Districts
3. Exemplary Programs in Physics, Chemistry, Biology and Earth Science

Volume 1, the 1982 program includes

1. Focus on Excellence: Inquiry
2. Focus on Excellence: Elementary Science
3. Focus on Excellence: Biology
4. Focus on Excellence: Physical Science
5. Focus on Excellence: Science/Technology/Society

Volume 2, the 1983 program, includes

1. Focus on Excellence: Physics
2. Focus on Excellence: Science in Middle/Jr. High
3. Focus on Excellence: Science in Non-School Settings

Volume 3, the 1984 program, includes

1. Focus on Excellence: Chemistry
2. Focus on Excellence: Earth Science
3. Focus on Excellence: Energy Education

Volume 4, the 1985 program, includes:

1. Focus on Excellence: Career Awareness
2. Focus on Excellence: Pre-Service Elementary
3. Focus on Excellence: K-6 Science

VIDEO RECORDS

We are still interested in receiving as many video tapes of your most effective lesson. Analysis of such tapes will be one important component of our evaluation efforts. We are particularly interested in such evidence for those trying STS modules and/or courses. STS efforts require specific questioning strategies, a focus on real problems, the weighing of evidence, practice with decision making. Such approaches are seen to be radically different from those found in the typical science classroom where the focus is invariably upon the acquisition of science knowledge.

Your ideas for other types of evidence of program impact, of changes in schools, of improved student interest and learning are needed!

IASCD ARTICLE (No Science in Science Classes)

George Gaylord Simpson has defined science in a short concise manner which captures its essence. It is a definition that is accepted by most scientists and science educators. Such a definition is important as decisions are reached about textbooks and their use in instruction. Since we know that 90% of all science teachers use a textbook in excess of 90% of the time, the view of science portrayed in textbooks is important. Again, it is a record of the science nearly all students experience in school.

Simpson's definition of science is: "Science is an exploration of the material universe in order to seek orderly explanations (generalizable knowledge) of objects and events: but these explanations must be testable."

The definition identified the three essential ingredients of science. The first of these is exploration—examining the objects and events in the material universe. Such exploration and/or examination requires curiosity, a natural commodity in the make-up of most human beings, a commodity in abundance in most students, a commodity that many teachers (and parents) find discomforting—something that should be placed "in check"—something that the school needs to control.

When one examines typical course outlines, curriculum guides, and the textbooks commonly used, there is virtually no indication that student curiosity is permitted or encouraged. There is no indication that students are encouraged, invited, or allowed to explore anything of the universe—other than the information found in the text. The exploration is limited to the ideas and the information that is provided.

The second ingredient of science is one of explanation—i.e., offering explanations of the objects and events encountered during acts of exploring the universe. This means that basic science is vitally concerned with people attempting to explain the things they see or wonder about. Education in science should provide opportunities for students to explain discrepant events, the things that interest them, the questions that occur to them. Science classrooms should help students develop better skills of explaining phenomena and/or objects/situations.

Again, when one examines course outlines, lesson plans, and science textbooks, there is no indication that information, practice, or attention is given to students and their power of explanation. Students are presented with information to be learned. It is merely assumed that if they "master" information called science that they will be able to use it. And, most agree that one use is offering explanations of the phenomena. However, there is no evidence that students ever develop such skills—and, if they do, that it is related to science instruction.

The third ingredient of science is one of testing the explanations that are formulated--either by a given person or others. The act of devising tests for checking out the validity of explanations is basic science. Carrying out such tests is also an important activity.

When one checks course outlines and textbooks again, it is impossible to find any indication that students are permitted or expected to test any ideas—and perhaps most important their own. However, it is difficult to see how experiencing science as exploration, explanation, and testing explanations could be included as a course outline and/or a textbook. It is this realization that makes it such a pity for most to view school science as the content in course outlines or that found in textbooks. All the basic ingredients of science are ignored!

When one studies common teaching practices, curriculum guides, and textbooks in use in school science, it is easy to conclude that no real science can be found in K-12 science courses. Of course, this means literally accepting a definition of science—like the one advanced by George Gaylord Simpson. However, once such a definition is accepted it behooves us all to plan real science in keeping with such a definition for courses labeled science. This is exactly what an STS program is designed to do.

Robert E. Yager

IOWA HONORS WORKSHOP TO END

July will be the official end of the three year grant to support the Iowa Honors Workshop. During the summer a total of 404 leader-teachers were involved in workshops designed for the following purposes:

1) To bring exemplary teachers in contact with each other, university staff members (including scientists and engineers), leaders of professional societies, and other community leaders in order that their ideas could affect others while also being stimulated further.

2) To assist the teacher participants with the development of specific products. These included:

    a) manuscripts describing their progress and teaching strategies;
    b) manuscripts reporting evaluative information (evidence) concerning the effectiveness of their materials and products;
    c) curriculum materials from whole courses, modules within a course, and/or collection of activities to supplement units and courses;
    d) specific plans for conducting workshops and/or other in-service sessions;
    e) studies of the effectiveness of such workshop plans;
    f) description of unique teaching strategies;
    g) proposals for funding of specific dissemination, development, or evaluation efforts;
    h) position papers designed to improve the profession;
    i) plans for more publicity and community involvement in science education efforts;
    j) involvement in state and national science and science education societies.

3) To measure impact of exemplary materials and teaching in schools with students; to expand the number of schools and students where such exemplary situations exist.

All participants are now being asked to help provide evidence of how well we met these objectives!

FOCUS
ON
EXCELLENCE

may 1987

vol 4 no 3

Honors Workshop Newsletter

THE LAST HONORS WORKSHOP NEWSLETTER

This is scheduled to be our last communication via this newsletter series—funded as an important communication device in our grant. We are overwhelmed with all the products and friendships and activities that have occurred during the three years. Surely some would have occurred without the Iowa Honors Workshop effort--but, we probably wouldn't have known about them.

We have been privileged to know all of you—500 teachers and the 54 association leaders who were mostly involved the first year of the project. And, we all look forward to many more years of associations in all kinds of other science education activities.

We continue to urge you to refer to the NSF grant in your workshops, articles, and activities. The number is TEI-8317395.

NSTA'S ETR PROGRAM

NSTA's Every Teacher Research program is a natural for Honors Workshop participants. All participants have been encouraged to write articles, to present at conventions, to conduct workshops. All of these activities are enhanced if they arise from a data base—real evidence and not merely hunches and gut-level feelings.

Certainly we invite more persons to collect classroom information than can be used as a basis for decision-making. Such data-based actions are always great articles—and an example of the power of teachers as researchers. Much of the information collected is more valuable than much of the researchers research in terms of its impact on learning, school programs, and student growth. We would like to think that the Honors Workshop helped to boost ETR in terms of impact and membership response. Let's keep it up!

TESTING IN ALL FIVE DOMAINS

We have been able to collect examinations and assessment instruments that can be used in all five domains of science education. We encourage that copies be secured--that shorter versions be developed and used in every school. We continue to collect information in our Iowa Chautauqua programs in all domains, especially the one of primary concern—"applications and connections."

The listing of instruments that are commended to your attention include:

Domain I - Knowing and Understanding (knowledge domain)

1) Science Subtest, Iowa Test of Basic Skills (Hieronymus, et al)
2) Science Subtests, Iowa Tests of Educational Development (Feldt, et al)
3) Science Subtest, Metropolitan Achievement Tests (Prescott)
4) Stanford Achievement Test (Madden, et al)
5) ACS/NSTA Cooperative Chemistry Test (ACS-NSTA)
6) Physics Achievement Examination (AAPT-NSTA)
7) Biology Comprehensive Final (BSCS)

Domain II - Exploring and Discovering (process of science domain)

1) The Methods and Procedures of Science: An Examination (Woodburn)
2) Test of Enquiry Skills (Fraser)
3) Wisconsin Inventory of Science Processes (Welch)
4) Cedar Rapids Schools Science Process Measure (Phillips)
5) Scientific Curiosity Inventory (Campbell)

Domain III - Imagining and Creating (creativity domain)

1) Purdue Creativity Test (Lawshe, et al)
2) Torrance Tests of Creative Thinking (Torrance)
3) Modes of Thinking in Young Children (Wallach, et al)
4) How Do You Really Feel About Yourself (Williams)

Domain IV - Feeling and Valuing (attitudinal domain)

1) Student Preferences and Understandings (NAEP)
2) Scientific Attitude Scale (Moore and Sutman)
3) Attitude Toward Study of Science (Yager)
4) Test of Attitudes on Technology-Society Interaction (Piel)
5) Attitudes Toward Science and Technology (Temple University)
6) Test of Science-Related Attitudes (Fraser)

Domain V - Using and Applying (applications and connections domain)

1) Science and Society (Dagher)
2) Views on Science-Technology-Society (Aikenhead)
3) Test on the Social Aspects of Science (Korth)
4) STS Examination Items for Science in a Social Context (ASE)

FLORIDA WORKSHOPS

The series of workshops offered in both Broward and Hillsborough Counties in Florida have concluded. Great enthusiasm is reported from the participating teachers. Several staff report involvement in upcoming summer institutes and workshops.

MORE SURVEYS??

We appreciate the time that has been given to the completion of participant assessment forms and to the identification of final products (and provision of samples). The job of tabulating all the information is a huge one. We are sure that many participants think we deserve the problem after requesting so much information. Such a life!

We are in your debt—those who responded so quickly and so completely. And yet, we are still anxious to hear from those who continue to collect information for completing the questionnaire and scales. Your input will never be too late! We hope to continue our writing and our efforts into the distant future. We feel we have learned much about how excellent programs emerge, evolve, and spread! You've made our learning possible!

SUPPORT STAFF REDUCED AT IOWA

The Science Education Center—not unlike all academic units at The University of Iowa—will find fewer members of its support staff. Two full-time secretaries have been terminated—effective July 1. Such cuts have occurred across the University. Unfortunately science education has enjoyed the service of a support staff that has been larger than the situation in most other units—hence the justification for cuts this year.

The loss of secretarial assistance will make it even more difficult to maintain communication and cooperative projects as the 1987-88 academic year approaches. Let us know if you have ideas for regaining such losses. We are anxious to keep active and productive in spite of such reductions.

TWEED PROPOSED AS DIRECTOR FOR FOLLOW-UP PROJECT

Another proposal is being processed at NSF. Paul Tweed, Coordinator of the Iowa Chautauqua Program, and Daniel Sheldon are listed as co-directors. An abstract of the proposal follows:

Four science courses will be offered each semester for 20 K-6 teachers in four population sites in Iowa each of six semesters (eight courses per year or four per semester) during a three-year period, 1987-90. The courses will be taught in laboratory settings (the local high school, community college, area education agency, or private college). Each course will include 14 evening class sessions with additional work assigned for completion during the week—and other in classrooms with elementary school students. The four courses will focus on applications of biology, chemistry, physics, and earth science. The exact discipline focus will depend on teacher interest and availability of staff teams in a given center. Staff teams will be headed by a scientist (from teaching staff of colleges across the state), a teacher from an exemplary program, and a teaching assistant from The University of Iowa. The workshops will focus upon meaningful science that can be applied to daily living experiences, local societal problems, and career awareness. Although basic science knowledge will be considered, the choice of topics will be restricted to those useful in understanding real world phenomena or for problem resolution. There will be an emphasis upon the use of the information, the approaches taken to science, and the activities that can be used with students in the schools of the teachers enrolled. During a three-year period 480 elementary teachers will be enrolled in such a workshop.

STS IN IOWA

John Penick has been awarded a new three year grant to promote STS in science classrooms in Iowa in grades 4 through 9. The project will mean that a minimum of 150 new teachers will be involved with developing, using, evaluating, and sharing STS curriculum modules.

The program will tie directly to the statewide effort in Iowa to improve science in grades 4 through 9. The evaluation will focus upon all five domains of science education, namely knowing and understanding domain, exploring and discovering domain, imagining and creating domain, feeling and valuing domain, and using and applying domain.

All Honors Workshop participants from outside Iowa are invited to visit and to study this continuing effort in Iowa. In many respects, we would welcome the chance to help with STS activities in all states. However, the current NSF philosophy emphasizes the importance of geography and the value of being able to remain in direct and frequent communication.

CLASSROOM ASSESSMENT

Many of you involved with the 1986 workshops have been assessing your students. We have collected considerable data and just now as this newsletter is being prepared we are receiving envelopes of post assessments. Thank you for your efforts and for being so attentive to our needed deadlines.

We hope to turn all the data around quickly. If you have been helping with assessment you should receive information from us this summer detailing the tabulations within your own classroom and the overall findings. We will be sending this information to your home address.

BECAUSE YOU'RE SPECIAL

..........a note from Joan

With few exceptions I have had opportunity to meet and spend some time with most of you. In this our last newsletter I would like to spend a few paragraphs of print sharing my perceptions of you, the many science educators who have been involved with our Honors Workshop Program. You, of course, are each unique but as a group have exuded certain qualities of which I feel you should be reminded.

You are dedicated survivors of the educational system who have obviously done more than survive. Your interest in quality education (which comes from your primary concern for your students) combined with your energy and enthusiasm have propelled you toward constant growth, personal and professional. You are humble and open in your search for growth directions. Our workshop program has been a vehicle for your movement down that road of growth (I am sure there have been others). You have been caught up in a cycle of success with one exciting thing leading to another. Even the professional "downers" fail to turn you off on a side road.

I have enjoyed knowing, working with, and studying you—remember all those surveys. You deserve a round of applause and I am sure the wonderful workshop staffs we have had across the three years join in spirit. Do "carry-on" with all the wonderful, unique things you each are doing. Lucky are the students you serve!

I expect to see many of you at meetings, etc. And about those surveys, I will be happy to send you more detailed findings on any of them (see article in this newsletter on one). Just drop me a line...

WHAT YOU THINK

Those of you who attended one of our workshops in 1985 or 1986 most likely completed a questionnaire asking for your opinions in several dimensions of science education. This is a brief general description of what you collectively think. Let me know if you would like a copy of a more detailed analysis.

One question asked you to identify the necessary elements for an outstanding science program. The top choice (selected by 90% of you) is a high level of enthusiasm. Administrative support, strong organizational skills and leadership ability, and expertise in one's field are also highly valued. Also important but with a lower percent of agreement among you are support from other teachers, graduate coursework, and administrative involvement.

You indicate that you feel well supported from varied sources. You consider students to be your greatest source of support, followed by principals and parents. School boards and other teachers are also sources of support although not as frequently mentioned as the three previous categories.

You feel your opinions are valued in your professional settings. You report that you feel confident, that you are encouraged to be innovative, that you enjoy sharing ideas with other teachers, that your enthusiasm is high and your work extremely self-satisfying.

With all these great feelings you might guess that relatively little frustration is reported, and you are right. Some frustration exists, however. Lack of time appears to be your biggest concern, followed by administrative policies, and lack of adequate materials.

The achievement of your students is your greatest measure of self-worth. Administrative approval, peer support, and outside recognition are also identified as meaningful contributors to feelings of self-worth.

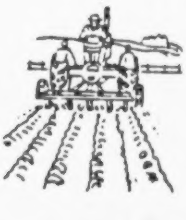
Despite all these positive attributes, most of you are not highly satisfied with your programs. (I would remind you here that two characteristics of exemplary teachers are the constant search for improvement and feeling you have never arrived—perhaps flip sides of the same attitude.) You also indicate that your future plans include remaining in your present professional position, continuing with curriculum innovation, and ongoing or increased involvement in professional organizations.

Please remember that this generalized narrative description is based on the means or averages of your responses, and, as such, is a general profile, not a specific individual. I'd love to hear from you as to how well you think the profile fits.

Joan Tephly

SCIENCE SHY TEACHERS?

That's not any of you reading this newsletter. But it is the thrust of a newly developed book of science activities for the elementary teachers which you or someone you know might like among a professional library. Its authors are Ellen Smith, Marilyn Blackmer and Sandy Schlichting of Hillsborough County, Florida. The book is titled "Super Science Source Book," and is available for around $20.00 from IDEA Factory, Inc., 10710 Dixon Drive, Riverview, Florida 33569.



PARTICIPANT ACTIVITY

New honors of which we have become aware:

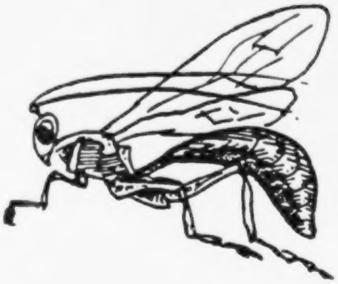
- Barbara Clark (Elementary '85 and STS '86) named Checotah Teacher of the Year in her home state of Oklahoma;
- Dale Rosene (STS Leadership '86) Marshall, Michigan, received an NSTA Distinguished Teaching Award;
- Thomas Knorr (Middle/Jr. High '85) Pen Argyl, Pennsylvania, received the Sheldon Exemplary Equipment and Facilities Award;
- Ron Bonnstetter (first project coordinator for the Honors Workshop Program) for his SESE recognition in the Secondary School Teacher Education category;
- David Tucker (STS '85) for the recognition of his program in the SESE category of S/T/S Revisited.

CONGRATULATIONS TO ALL!!

Many familiar faces participated in the NSTA Convention in Washington:

Jane Abbott, Kathleen Gulley, Donald Birdd, Anne Barefoot, Dot Helms, Linda Crow, JoAnne Wolf, Kathleen Ranwez, Michael Demchik, Bill Dutton, Kevin Koepnick, Diane Weinholtz, Sam Chattin, John Butler, Thomas Knorr, James Bodolus, Joan Hall, Marilyn Szymaszek, Robert E. Lewis, Elizabeth Horsch, Diana Doepken, Paula Edwards, Gary Appel, Terry Switzer, Carol Snell, Carolyn Brockway, David Lindahl, Donna Robinson, Donald Iman, Vicki Moon, Dana Van Burgh, Jenepher Lingelbach, Bonnie Brunkhorst, Herb Brunkhorst, Robert Sigda, Bonnie Talbot, Carol Wilson, Gail Foster, Dale Rosene, Marvin Selnes, David Tucker, Jon Harkness, A. Rick Davis, Linda Froschauer, Patricia Smith, Beverly McMillan, and M. Lynn Chattin.

Wow! We're impressed! If we missed you, we didn't mean to.



WASHINGTON SEMINAR/REUNION

About 130 persons gathered for an evening of sharing and conversation at the NSTA meeting on March 27. It was a time for re-establishing contacts, meeting new teachers who had been active a different year, and exchanging materials.

Rosamund Hilton—who continues after her first efforts at photography to be a champion—was able to catch many people off-guard and some looking better than anyone can remember. She is willing to provide prints of any and/or all of the shots she got at one dollar per print. Her address is:

Rosamund Hilton
Henry H. Nash School
4837 West Erie Street
Chicago, IL 60644

The entire staff was pleased to see and to interact with so many from our workshop participant list!

VIDEOTAPES ARE COMING!

Thanks to those of you who are going "on film." If you'd still like to be one of the group, consult a previous newsletter or call us for details.

KNOW WHERE YOU LIVE, AND LIVE THERE
STS AND THE BIOREGION

As STS begins to assume an integral part in many classrooms across the state and throughout the nation, we can now step back and assess the nature of our programs. Where are they headed? What perspectives are they assuming? How can we improve upon our existing STS programs?

One avenue of exploration that can give direction and help improve STS programs is the perspective of bioregionalism. The term bioregional is relatively new, not more than 10 or 12 years old, but it has opened up alternative (or helped us integrate new and old) territory in science. "Bioregional" comes from bio, the Greek word for forms of life, and regio, Latin for territory to be ruled. Together, they mean a life-territory, a geographical area where rough boundaries are set by natural phenomena, not human dictates, distinguishable from other areas by characteristics of flora, fauna, water, climate, rocks, soils, landform, and the human settlements and cultures these characteristics have given rise to. If the concept seems strange, it may be a measure of how distant we have become from the wisdom and insight it conveys.

The first question we must ask of ourselves and our students is: Where do we live? Since the beginning of the industrial age, only about 200 years ago (and only about two or three decades ago for much of the world), the answer to this basic question has been framed in more urban, statist, and technological terms, rather than in those of the process of life itself. Ask the students in your class and expect most of the replies to be somewhat similar to these: in a numbered house on a street; in such and such town; in a state or nation. All of these are, of course, very accurate to a degree, but they do not encompass one of the fundamental premises of our existence.

We all live some place; it's how we interpret the place we live that distinguishes the way we relate to it and controls our actions towards it. The bioregional perspective can help students bridge the gap between society and the natural world; it can provide a framework for the study of science-technology-society interactions and their ultimate impact on the local region the students live in.

A bioregion can be interpreted in many ways, some of which would be highly specific such as an area with a specific natural vegetative cover, or it can be a general area such as a watershed, a valley, or a mountain range. In Iowa, we could interpret our bioregions in many ways also; the Mississippi and Missouri River watersheds are both in our state, as well as numerous local watersheds that drain into our eastern and western natural river boundaries.

Any place is within a bioregion—towns, villages, urban metropolises, forests, lakes, and farming areas are all contained within a specific "region." The northeastern section of Iowa, called the driftless area, with its steep bluffs and forest cover is distinct from the prairie-pothole section of central and northwest Iowa. The loess hills along the Missouri River valley are very distinct contrasted with the rolling hills and river systems of southeast Iowa. So you see, even our "tall corn state" is made up of many natural bioregions which can be explored, investigated and reinhabited.

With the advent of bioregional perspectives, many of our so-called environmental disasters become less frightening and more manageable. For one thing, people don't usually think of themselves as inhabitating a specific region; therefore, they don't have a working knowledge of how to live there. People also do know that their region's environment is being assaulted and imperiled (Iowa's groundwater pollution, the disposal of toxic and industrial wastes, landfill dilemmas and other relevant issues come immediately to mind). Most often, people feel these problems are generated by forces they do not understand and cannot control. The notion of environmental health is new in the public consciousness, and thanks to the many problems we now recognize, the public as well as our students can be aroused and actively encouraged to seek solutions. This is where STS and the bioregional perspective meet and form a productive alliance.

Traditionally, science has been presented as a body of knowledge to be mastered, processes to conceptualize, and skills to be developed. The STS approach encourages teachers to move from the traditional approach to a more relevant, local issue- oriented science, a science students can experience, touch, see, smell and feel. One may even call STS a move towards making the use of science meaningful to individuals involved. But, is it meaningful for students in your classroom to study about the far-off effects of acid rain, toxic wastes, or other large-spectrum issues? Can they relate it to their lives? Or, would it be more closely related to the students' needs if they had the opportunity to seek information and explanations about the local region in which they live, which may in turn bring them to a local perception of the effects of acid rain, toxic wastes, etc.? The phrase "think globally, act locally" can now begin to develop a whole new impact.

There are four central aspects to developing an STS curriculum with a bioregional perspective: 1) knowing the land; 2) learning the lore; 3) developing the potential; and 4) liberating the self.

The initial task is to understand place, to know the land, the specific place in which we live. The types of rocks and soils under our feet; the sources of the water we use; the paths of our refuse, liquid, solid, and gas; the nature of our local weather; the common insects, plants, animals, and landforms; the times to plant and harvest; what types of natural foliage is edible, these are some of the things that help us know our place. The cultures of the people must also be understood—from the early history of the area to the present, including social and economic arrangements of the area and their impact on the region in both urban and rural environments.

Much information is available, and developing a local resource inventory for the region is a great way to start. The local forest service or soil conservation service maps can be used to map the vegetative and forested areas; checking hydrological surveys can determine waterflows, hydropower sites, and runoffs; learning annual climatic conditions and developing estimates of the full potentials of solar, wind, and water power; collecting biological profiles of the area's native vegetation; and studying human land-use patterns and optimal settlement areas and arrangements. Ultimately, people could develop knowledge that would have impact on determining the natural limits of a region in which sustainable societies could live.

Earlier peoples, particularly cultures well rooted in the natural cycles of the earth, knew a number of things we through modern science are only beginning to find out. Learning the lore, the history of an area, is also a valuable tool in understanding your place. Every place has a history, a record of the human and natural possibilities of the region. This can be studied with a new outlook. A virtual library of information is available if we would recognize its value and begin to use it. From collections of oral Indian lore and folk knowledge, to the values of herbal medicines, methods and times of burning prairies, the location and building of solar houses for maximum gain, the land-use history, and many other natural and human resources, we can gather information useful in our quest of knowing our place.

Within a given region, the development of the potential to act in an impactive manner becomes much easier when we begin to know our place. No longer do many of our problems and local issues seem out of our control, we begin to see some logically derived solutions which can be implemented locally. We must try to use the knowledge and experience we accumulate to formulate ways of living within our bioregion. Developing a healthy relationship with our areas can be constrained only by the logic of necessity and the laws of ecology. Acting to improve our regions we are in turn enhancing the quality of our communities and learning that we can have impact. This is a point many students fail to recognize when we present them with their upcoming inheritance of global problems.

The final aspect of the bioregional perspective is very closely associated with the development of the region's potential. In developing the region's potential, we also liberate the individual's potential.

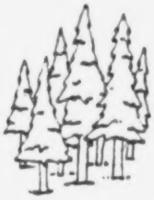
Within a region the students would see their role as contributors to and of being in control of interactions with their immediate environment; thus, helping them shape their own destinies. The phrase, "There is nothing I can do about it," begins to fade into distant memory. Also, working towards an understanding of our regions necessitates a closer connection with our local lands and people. Being connected, almost daily, to pursuits related to our community and the surrounding natural world can help foster the values of cooperation, participation, sodality, and reciprocity which enhance individual development.

The task of developing and integrating our STS programs with a bioregional perspective is obviously not easily accomplished. But, if you think about it, many of us already are doing things we could tag with the label "bioregional," just as we were teaching the STS approach before anyone called it STS. The usefulness of having a label for what we do is it can help us provide a rationale for our actions and develop a sense of direction and purpose for how we are teaching.

For more information on organizations developing bioregional materials for classroom use and general information about the study of bioregions, contact: 1) The Planet Drum Foundation, Box 31251, San Francisco, CA 94131; 2) The Institute for Earth Education, Box 288, Warrenville, IL 60555; 3) Sunrock Farm, 103 Gibson Lane, Wilder, KY 41026.

And don't forget, everything is connected to everything else.

Paul C. Tweed



Florence Kane (Energy Education Exemplar '84 and Honors Workshop participant '85) along with her husband, Andy Kane, report the development of a new environmental education program located at Camp Thunderbird and sponsored by the Charlotte-Mecklenburg YMCA. One to three day programs for schools and other interested groups will be piloted in the fall. The major goal of the program is to build understanding of the interdependence between people and nature. We know they are building on the outstanding example of the Outdoor Education Center in Trinity, Texas. If you would like to get in touch with Florence, her address is: One Thunderbird Lane, Clover, SC 29710 (803-831-2121).

APPENDIX VI

SAMPLES OF CHAUTAUQUA NEWSLETTER

CHAUTAUQUA NOTES

SCIENCE EDUCATION CENTER
VOLUME 2, NUMBER 1
THE UNIVERSITY OF IOWA
SEPTEMBER, 1986

Joe Piel - National STS Leader - Returns to Headline Iowa Chautauqua Workshops

Joe Piel is internationally known as an educator, STS advocate, curriculum developer, teacher/administrator, and engineer. He headed the Project Synthesis STS Focus Gray in the 1978-81 NSF research project that has received international attention. He headed the STS team that spent the summer of 1985 working with U.S. dependent schools and their moves to STS around the world.

Joe Piel taught high school physics; he's been an elementary school principal; he was a principal developer of Man-made World—an innovative NSF-supported curriculum effort of the 60's.

Joe was born in New Jersey where he has made his home for several decades. Currently he chairs the Department of Technology and Society in the College of Engineering at the University of New York—Stony Brook. Such a department is unique among colleges of Engineering—and they have a unique person in Joe Piel as Chair.

Joe Piel has been active in numerous national professional associations; he is leader in promoting business/industry/education collaboration. He has been active with cooperative projects with Bell Laboratories and DuPont.

We are all fortunate that Joe Piel will be returning to Iowa to share his experiences, his insights, his enthusiasm, his wit, and his common sense! His involvement promises to add sparkle and excitement to the Iowa Chautauqua program for 1986-87.

A Word About our Sponsor The Iowa Utility Association

Our Chautauqua Program is made possible by funding under a grant from the Iowa Utility Association in addition to grant funds that we receive from the National Science Foundation. The following article provided by the Association will acquaint you with the member companies in the Association and the areas of the state they serve. In future issues, we will have other articles on the role of utilities as energy providers in Iowa.

Three types of utilities serve Iowans. Municipal utilities are owned and operated by local governments. Rural Electric Cooperatives are owned and operated by the members that they serve and were developed under a federal program to extend electricity to farms and other rural properties. Investor-owned utilities are privately owned. It is the third group of utilities which comprise the membership of the Iowa Utility Association.

Perhaps a look at the individual companies will help you to identify with the member company which serves the part of the state in which you live.

Interstate Power Company, with headquarters in Dubuque, is a combination electric and gas utility primarily engaged in the generation, transmission and distribution of electricity and the distribution of natural gas. It distributes electricity to 155,750 customers in 234 communities and surrounding rural areas and sells wholesale to 19 communities. Natural gas is distributed to 45,218 customers in 24 communities. The company's service area encompasses over 10,000 square miles in the northwest corner of Illinois, northeast Iowa and southern Minnesota.

Iowa Electric Light and Power Company, with headquarters in Cedar Rapids, provides electric, natural gas, steam and rail services. It operates four coal-fired power stations, a nuclear plant and other small supplemental generating facilities. electric service is supplied to approximately 206,000 residential, commercial, industrial and rural customers in 55 counties including 392 cities and communities. Natural gas is distributed in 124 cities in Iowa. The company also provides natural gas service in one community in Minnesota, one community in Colorado and five small communities in Nebraska. The company delivers steam for heating and industrial purposes in Cedar Rapids.

Iowa-Illinois Gas and Electric Company, headquartered in Davenport is engaged in the business of generating, transmitting, distributing and selling electric energy and distributing and selling natural gas in the states of Illinois and Iowa. The company serves 158,897 residential customers with electricity and distributes natural gas to 206,937 residential customers. Its service territory is primarily in eastern Iowa and Fort Dodge, Iowa.

Iowa Power and Light Company, based in Des Moines, is engaged in the business of generating, transmitting, distributing, and selling electric energy. The company serves approximately 236,900 electric customers in a 5,600 square mile area in the state's central and southwest regions.

Iowa Public Service Company, is based in Sioux City and its division *Iowa Gas Company* is based in Des Moines. Electric energy is provided to 156,369 customers in 228 Iowa and five South Dakota communities. Gas is distributed to 326,269 customers in 246 communities in Iowa, Minnesota, Nebraska, South Dakota and Florida.

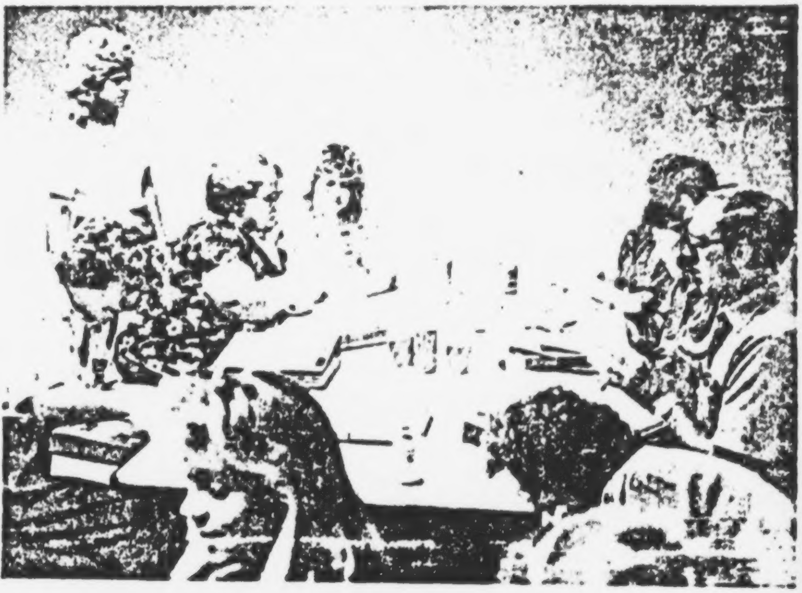
Iowa Southern Utilities Company, in Centerville provides electrical energy to 93,267 customers and natural gas is distributed to 37,709 customers. The company's customers are located in the south and central part of the state.

Peoples Natural Gas Company, headquartered in Council Bluffs serves about 299,000 customers located principally in Minnesota, Iowa, Nebraska, Kansas and Colorado. Peoples also operates a natural gas pipeline system for end-use customers in central Kansas and brokers natural gas.

Union Electric Company, is headquartered in St. Louis, Missouri, with a regional office in Keokuk, Iowa. The company serves a 24,000 mile service area in Missouri, Illinois and Iowa providing service to more than one million customers. The company serves the southeastern corner of Iowa.

The Iowa Utility Association, based in Des Moines, Iowa, is a trade association in which each of the companies mentioned above are members. Among the Association's activities are the coordination of state-wide industry programs such as its grant to the Chautauqua Program. The Association has a long history of support for education. Some programs supported in the past have included student assembly programs conducted by Oakridge Associated Universities and a summer program for high ability students conducted by Dr. Lynn Glass at Iowa State University. In recent years, the Association has focused its support in providing educational opportunities for teachers. The Association provided a grant to Energy and Man's Environment to support a teacher workshop program coordinated with the Iowa Department of Public Instruction and the Iowa Energy Policy Council through the 1984-85 school year.

In the spring of 1986, the Asociation sponsored two Chautauqua workshops conducted by the Science Education Department of The University of Iowa and has now provided a grant to the Chautauqua Program for the 1986-87 school year. We are very enthused about the Chautauqua Program. The program allows teachers to explore new activities with which to develop the concepts in their curriculum, to try out these activities in the classroom, and then to evaluate them with their peers. There are many excellent resources available to Iowa teachers. We believe the Chautauqua Program provides an excellent format for teachers to learn about and utilize these resources. Dr. Yager brings to the workshops a broad experience, enthusiasm and understanding of the challenges teachers face. We hope teachers attending the workshop find it an excellent opportunity for self-development and will continue to share their experiences with other teachers through the Chautauqua network.



Teacher/leader Dee Ford, Hunt School in Sioux City, works with primary teachers as they review Energy Source materials.

Help Locate Exceptional Teachers for New Program

We still have openings in our fall workshops for exceptional teachers. Past participants, Iowa supervisors, elementary/middle school principals are urged to help identify the teachers and schools for involvement in the four workshops. Application forms are appended to this newsletter. Extra copies can be duplicated and used. Applications are to be forwarded to:

Chautauqua Office
759 Van Allen Hall
University of Iowa
Iowa City, Iowa 52242

If you have questions, please write or call our office. Our phone number is 319-353-3384. The phone is answered 8:00 a.m. to 5:00 p.m. If we are not in the office, we will return your call. We have listed below the representatives of the member companies of our sponsor, the Iowa Utility Association. If you are served by one of these utilities, you may wish to contact the individual designated for additional information about the workshops.

Jim Esmoil
Interstate Power Company
1000 Main Street
Dubuque, IA 52201
(319) 582-5421

Myrna Fisher
Iowa Electric Light and Power
P.O. Box 351
Cedar Rapids, IA 52406
(319) 398-4558

Robert Grubaugh
IA/ILL Gas and Electric Co.
621 18th St.
Moline, IL 61265
(319) 326-7058

Brain Johnson
Iowa Power
666 Grand Avenue
Box 657
Des Moines, IA 50303
(515) 281-2571

Judy Dunagan
Iowa Public Service Company
401 Douglas Street, Box 778
Sioux City, IA 51102
(712) 277-7480

Keith Sherman
Iowa Southern Utilities Company
300 Sheridan Avenue
Centerville, IA 52544
(515) 437-4400

Julie Cammack
Peoples Natural Gas Company
#Corporate Pl., Suite 210
1501 42nd Street
West Des Moines, IA 50265
(515) 223-6010

Dave Sprunger
Union Electric Company
Box 487
Keokuk, IA 52632
(319) 524-6363

Sponsor Coordinator
Jack B. Clark
Iowa Utility Association
P.O. Box 6007
Des Moines, IA 50309
(515) 282-2115

These individuals can help complete arrangements and can provide first hand information about the Iowa Chautauqua program.

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Teacher Workshops Set for 1986-87 Chautauqua Program

The dates and places for the 1986-87 Chautauqua series are:

Buena Vista College
Storm Lake

1) September 19, 20, 1986
February 27, 28, 1987

Luther College
Decorah

2) October 3, 4, 1986
January 30, 31, 1987

Springbrook State Park
Guthrie Center

3) October 31, Nov. 1, 1986
May 1, 2, 1987

Jumer's Inn
Bettendorf

4) November 7, 8, 1986
March 13, 14, 1987

The program structure for each workshop will be similar.

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Curriculum Materials

September is a month of new beginnings for all of us. New faces, new names, new colleagues, new curriculum units and ideas. . . September is a new beginning for me also. My name is Amy Bruner and I have recently joined the Chautauqua staff. I have the exciting job of developing curriculum materials which we will publish and distribute to teachers. The products teachers send into our office will be my primary source in developing these materials. Even though we have received initial products from past workshops, the new school year is undoubtedly beginning with fresh ideas and new units developing into STS activities. I invite all of you to send in any additional fun and unique STS Science Curriculum (activities) materials which you develop throughout the year. Send to: Amy Bruner, Curriculum Materials, Science Education Center, Van Allen Hall, The University of Iowa, Iowa City, IA 52242.

Classroom Corner

In this feature section you will find the highlights of the teacher projects from last year's Chautauqua short courses. Each month several teacher-generated activities will be condensed and outlined. Complete texts of the projects will be available at a later date. For more information on the activity contact the teacher/authors listed in the endclosed participant roster.

Barbara Kinneer

Barbara Kinneer outlines a 14 day physical science unit on engines and energy. The unit, taught to sophomores and juniors, covers the history of engines, types of combustion. Teaching strategies used in this unit included: brainstorming, team learning, field trips and interviewing. Motivation was high and according to Ms. Kinneer was a good indicator of success.

Betty Rumer

Ms. Rumer has taught a junior high earth science unit on energy conservation. Utilizing the Energy 85 materials, the goal was to have students study the rate at which our energy resources are used and how they as individuals can conserve energy. Student response was very positive and as a result Ms. Rumer is planning to develop more energy units next year.

Curt Jeffryes

Mr. Jeffryes taught a sixth grade science unit on electricity. The goals of the unit included: 1) understanding the relationship between electricity and magnetism; 2) understanding the three ways current electricity is made; 3) to understand how electric motors and generators work and to understand how electricity is measured and controlled. Student response to the unit was great, especially to the large number of hands-on activities.

Doris Nelson

Ms. Nelson used solar energy as a focus for one of her fifth grade science units. Students looked at the advantages and disadvantages of alternative energy sources and then focused on the concepts of and the technological applications of solar energy as a source of heat. Activities included building a model of solar collection and a solar cooker.

Morgan Masters

Mr. Masters employed some interesting teaching strategies in the eighth grade physical science unit on energy alternatives, light energy and electricity. Students used 6000 dominoes to demonstrate the difference between a controlled nuclear chain reaction and one that was uncontrolled. During the unit on electricity, students were responsible for teaching a five minute lesson on anything related to electrical energy. These lessons were filmed and then given to other elementary instructors for viewing in their classes. Mr. Masters stated that the unit was extremely successful, mind-provoking, and the relativity of the subject matter stirred many questions.

Donna Terry

A light unit was taught in Ms. Terry's fourth grade science class and progressed from natural light energy to artificial light energy. Some of the materials used to teach this unit included: color wheels to demonstrate white light is composed of all colors; broken light bulb to trace electrical circuits; students made light bulbs: senior citizens were interviewed and students worked on energy booklets. Students were excited about their experience, wanting to do it again and show the principal!!

Supplimental Soil Science
"Mother Nature Script"

by Sindy Stiles
Fort Dodge

Good morning, boys and girls. I'm Mother Nature . . . and Mrs. Stiles asked me to visit your classroom today. I brought a present for you. Please don't open the packages yet (hand out . .).

This present is homemade. I made it myself. But it is something that man with all his scientific knowledge and technology has not been able to make without my help.

Mrs. Stiles told me that earlier this year you did some separation studies of mixtures. This present is a mixture of organic and inorganic materials. Can anyone tell me what organic materials are? (question—answer)

This gift is something priceless—you would not even be alive if it weren't for this gift. In fact Planet Earth would only be a dead, bare hunk of rock if I hadn't given this gift to the world. As far as we know our planet, Earth, is the only place in the universe where this gift is found.

This is more valuable than anything in the world and all of our wealth comes from it.

You may open your gifts now.

Pour your soil out of the plastic bag onto one of the paper towels on your tables.

The first thing I would like you to do is to separate all of the organic materials you can find from the mixture, and place the organic parts on the second paper towel.

Ask a few students at a time to take their baby food jars to the sink and get it ⅔ full of water . . . proceed with a "Soil Texture Test" activity. Remind students that it is organic material that is floating on top, and review "flotation" as a separation technique.

Iowa "Chautauqua" Graduates

As the 1986-87 academic year begins, our thoughts and efforts naturally focus on the new plans for the new year. However, past participants are colleagues and represent what we have been able to do in Iowa schools. The original Chautauquas in Iowa started as a national NSF project with Iowa being one of about 20 state efforts. The 1984-85 year was the first with 28 middle school teachers enrolled. This experience caused us all to seek further support and sponsorship that would permit more activity in Iowa and more teacher/school participants. The 1985-86 year involved 28 more in the continuation of the NSF/NSTA effort.

In addition, the Iowa Utility Association added tremendous support—both in terms of people and financial support—that enabled us to match two years of NSF/NSTA efforts. Two pilot programs—enrolling a total of 63 teachers—were held, one in Des Moines and one in Iowa City.

A roster of teachers and schools and project titles as now entered in our Chautauqua computer system is included in this newsletter. Are there errors? We want our new computer records to be accurate! We also want to hear of your continued successes and special STS experiences. This information will be invaluable as we plan to involve 160 more teachers and their schools in the growing STS focus for school science in Iowa during the current school year.

Spring, 1985 NSTA/NSF Chautauqua Short Course Projects

1) Sharon Antisdel/ Susan Johannsen West Middle School 600 Kindler Muscatine, IA 52778 319/263-0411	Energy Module
2) Rollin E. Bannow Southeast Jr. High 2501 Bradford Dr. Iowa City, IA 52240 319/351-8242	Ecology Unit Frogs, Bugs, and People
3) Steven Bateman/ Mark Patton Jones Jr. High 1090 Alta Vista Dubuque, IA 52001 319/398-2452	Flight—STS
4) Gerald Walsh Washington Jr. High 51 North Grandview Dubuque, IA 52001 319/557-9911	Flight—STS
5) Joseph Beach Franklin Jr. High 300 Twentieth St., NE Cedar Rapids, IA 52402 319/398-2452	Focus on the Environment

6) Keith D. Byers Disease Free
Monticello Jr./Sr. High World—
217 S. Maple St. A Study in
Monticello, IA 52310 Genetics &
319/465-3375 Genetic Engineering

7) Barbara Farmer Energy Activities:
Tilford Jr. High Batteries, Bulbs &
13th St. Thermometers
Vinton, IA 52349
319/472-4736

8) Cindy Garlock Technology—
Taft Jr. High Environmental
5200 E. Ave., NW Tradeoffs
Cedar Rapids, IA 52405
319/398-2243

9) Elwood Garlock Focus on Energy:
Taft Jr. High Sources/Applications/
5200 E. Ave., NW Affects
Cedar Rapids, IA 52405
319/398-2243

10) Bill Gerlits Making of a STS
Franklin Jr. High Film: Encounter
300 Twentieth St., NE
Cedar Rapids, IA 52402
319/398-2452

11) Frank D. Holland Simple
Iowa City Alternative Machines
School
509 S. Dubuque
Iowa City, IA 52240
319/338-8643

12) Gary R. Johnson Robots and
Grant Elem. School Such
254 Outlook Drive, SW
Cedar Rapids, IA 52404
319/398-2467

13) Larry D. Kettler STS: A Potpourri
Tilford Jr. High of Activities
13th St.
Vinton, IA 52349
319/472-4736

14) Elizabeth Koehn/ Reproduction
Barbara Snyder Module
West Middle School
600 Kindler
Muscatine, IA 52761
319/263-0411

15) Jerry E. Magrane Energy/Matter
Evans Jr. High Relationships
Chester St.
Ottumwa, IA 52501
515/684-6511

16) Elwyn O. Maloy/ STS Unit: Solar
Steve Bartlett/ Energy, Home
Douglas Smith Efficiency, and Food
Linn Marr Jr. High Science
3333 N. Tenth St.
Marion, IA 52302
319/377-7373

17) Alan J. Peck Model Solar Homes
Mt. Pleasant Jr. High
400 N. Adams
Mt. Pleasant, IA 52641
319/385-9013

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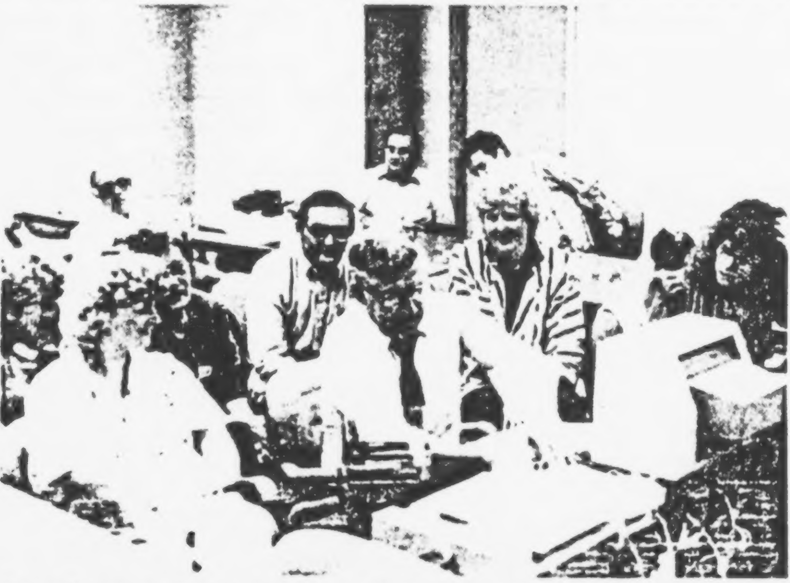

Dean Hartman, Grantwood Area Education Agency, demonstrates how to access educational activities on the Project 4-9 computer system.

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18) Beverly A. Phillips Focus on
Mt. Vernon Mid. School Technology
First St. E A Basic Approach
Mt. Vernon, IA 52314
319/895-6254

19) Jeanne A. Rogis Project Pumpkin
Oxford Jct. Jr-Sr. Patch
Oxford Jct., IA 52323
319/486-2721

20) Linda Sliefert/ Energy Awareness
John Francis Cooperative Learning
West Middle School Activities
600 Kindler
Muscatine, IA 52761
319/263-0411

21) Jack Spore Seed Biotechnology
Monticello Jr-Sr. High
317 S. Maple
Monticello, IA 52310
319/465-3575

22) Denny White Force & Motion
Mt. Pleasant Jr. High Development
400 N. Adams Module
Mt. Pleasant, IA 52641
319/385-9013

Industry Chautauqua
Des Moines - Iowa City

1) Susan M. Blunck STS Project
St. Augustin Elementary School
4320 Grand Avenue
Des Moines, IA 50312

2) Rollie K. Bramhall STS Earth and
East High School Science
815 East 13th
Des Moines, IA 50316

3) Edward R. Brown STS Earth and
Bondurant-Farr Jr/Sr. Science
Third and Garfield
Bondurant, IA 50035

4) Judith Carlson Frequency and
United Community Vibration in
Route 1 Music
Boone, IA 50036

5) John Cisna Frequency and
Parkview High School Vibration
109 N.W. Pleasant in Music
Ankeny, IA 50021

6) Elwin L. Emery Using Newspaper
Woodward-Granger STS
Woodward, IA 50276

7)Sharon Fisher Seatbelt Science
Meredith Transitional School
4827 Madison Ave.
Des Moines, IA 50310

8) Randolph Hansen STS Project
Brody Transitional School
2501 Park Ave.
Des Moines, IA 50312

9) Raymond J. Harden STS Speakers
Perry Junior High
10th & Willis
Perry, IA 50220

10) David Owen Hayes Science
S.E. Polk Jr. High Fairs
8325 N.E. University
Runnells, IA 50237

11) Gary Jensen Energy Ethics
Roland-Story Middle School
206 S. Main St.
Roland, IA 50236

12) Sharon Johnston Consumer
Webster City Jr. High Chemistry
740 Bank St.
Webster City, IA 50595

13) Jim Keegan
Manning Jr. High
Manning, IA 51455

14) Jim Kubichek Nuclear Weapons
Ventura High School
Ventura, IA 50842

15) Cynthia Lehrkamp Comparison
Manning Elementary of past and
Manning, IA 51455 present
Technology

16) Margaret Long
Manning Community School
Manning, IA 52455

17) Therese Y. Lukavsky Inter-
Holy Family School dependancy
1111 Garfield Ave. of people
Des Moines, IA 50316 & nature

18) Dick McWilliams Weather
Grandview Park Baptist School
1701 E. 33rd St.
Des Moines, IA 50317

19) Charles H. Peikema Water
Roland-Story Middle School
220 Main Street
Roland, IA 50236

20) Robert Hoy Technology:
Valley High School Past &
West Des Moines, Present
IA 50265

21) Edward L. Rezabek Science Fair
Glidden-Ralston Community Sch.
Glidden, IA 51443

22) John Rudisill Earth Science Fair
East High School
E. 13th and Maple
Des Moines, IA 50316

23) James L. Seivers Chemistry
Weeks Transitional School Water
901 S.E. Park Ave. treatment plant
Des Moines, IA 50315

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Teacher/leaders Ed Rezabek, Glidden-Ralston Community Schools (above), and Jim Galles, Westwood School in Mapleton (see photo, page 7), look on as secondary teachers complete a classroom activitiy. Ed and Jim were participants in last spring's workshops and are now sharing their experiences with other teachers.

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24) Geraldine G. Strippling Science
Manning Community Sch. Project
Manning, IA 51455 Guest
speakers

25) Frank P. Weibel Earthquake
Neveln Jr. High Prediction
306 School Street
Ankeny, IA 50021

26) Janice L. Ziettlow Aerodynamics
Hiatt Transitional
1214 E. 15th
Des Moines, IA 50316

27) Roger Spratt Ecology of a
K-12 Science specialist birdbath &
120 S. Kellogg Genetic screening
Ames, IA 50010

28) Lynn Terrill
Central Jr. High
6th & Clarke
Ames, IA 50010

29) Fred Trumble
1406 Eastern
Red Oak, IA 51566

30) Steven W. Anderson
3500 Belmar Dr.
Des Moines, IA 50317

31) Ruth Durham Heat Energy
921 Elm
Correctionville, IA 51016

32) Eric A. Korpanty Fossil fuel
210 Corene Ave. Consumption
Waukee, IA 50263

33) Marjorie Ranney Energies
802 N.W. Greenwood impact on
Ankeny, IA 50021 society

34) Phyllis Rosendahl Water & Air
3117 S. Nicollet Pollution
Sioux City, IA 51106

35) Marlee Schmidt Energy Video
1331 S. Maple
Sioux City, IA 51106

36) Margaret Stoltzfus Nutrition
1214 S. 2nd St.
Oskaloosa, IA 52577

37) Marshall Scichilone Energy
401 Ely St. Sources
Woodbine, IA 51579

38) Sheryl Mattern Energy-Use &
5055 S.E. 7th Conservation
Des Moines, IA 50312

39) Mary L. Brinkman Box 2 Aurelia, IA 51005	Natural Resources
40) Elaine Knudson RR 1 Sergeant Bluff, IA 51054	Scientists
41) Karen Holmes 508 Glen Council Bluffs, IA 51501	Bees STS Approach
42) Curtis Jeffryes 1216 N. Birch Creston, IA 50801	Electricity
43) Karen Brocksmith 1743 E. 21st Des Moines, IA 50309	Fossil Fuels
44) Naomi Hubbard 3535 S.E. 1st Ct. Des Moines, IA 50309	
45) Kristen Newton 122 Gunn Ave. Council Bluffs, IA 51501	Fossil Fuels
46) Phyllis A. Johnson 313 34th St. W. Des Moines, IA 50265	
47) Linda Munger 4607 Clinton Ct. Sioux City, IA 51106	Homes and Energy
48) Deloris E. Ford 2506 Jennings St. Sioux City, IA 51104	Power Switch
49) Roxanne Scovelle 3628 Virginia Sioux City, IA 51106	Weather Newscast
50) Jim Galles 803 Ring Mapleton, IA 51034	
51) Morgan Masters 216 Woodlawn Chariton, IA 50049	Nuclear & Electric Energy
52) Marsha Storbakken 613 N. 22nd St. Fort Dodge, IA 50501	Energy issues
53) Donna C. Terry RR 1 Numa, IA 52575	Light
54) Kristopher Groff 803 Nebraska St. Emerson, IA 51533	Nuclear Energy
55) Everly Post RR 1 Holstein, IA 51025	Energy Activities
56) Rick Wahl 4319 Shirley Omaha, NE 68105	
57) Larry L. Kimble Route 4, Box 88 Grant City, MO 64456	
58) Michael D.Jackson 3221 N. 56th Omaha, NE 68104	Conservation of Energy
59) Sandra K. Adams RR 1/22 Sandy Hill Dr. Orion, IL 61273	Fossil Fuels
60) Vicki Agee Lake Keoman Oskaloosa, IA 52577	
61) Stephanie Altholz RR 1, Box 369-A Montrose, IA 52639	Energy Conservation & Environment
62) Harold Asmus 203 W. 14th St. Cedar Falls, IA 50613	
63) Marilyn Atkinson 1846 B. Ave, NE Cedar Rapids, IA 52402	
64) Tom Aunan RR 2, Box 75 Williamsburg, IA 52361	Calories
65) Steve W. Bateman 2661 Maryland Dr. Dubuque, IA 52201	Energy Efficient Homes
66) Gary Cedarlund 922 Prarie Meadow Ct. Waterloo, IA 50701	Decision Making Process
67) Beverly Cook 2012 E. 4th Waterloo, IA 50703	Energy Conservation
68) Chris Day 408 15th Ave. Grinnell, IA 50112	STS for Classroom Teachers
69) Creig Dunlap 1904 Grantwood Iowa City, IA 52240	
70) M. Kay Flannery 160 Ravencrest Dr. Iowa City, IA 52240	Conservation of Fossil Fuels
71) Colleen Goodenbour 2625 Highview Ave. Waterloo, IA 50702	Energy Production, Use & Conservation
72) Del Holland 1039 E. College Iowa City, IA 52240	Aerospace
73) Barbara Kinneer 410 Franklin Burlington, IA 52601	Engines & Energy

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Jim Galles, Westwood School, Mapleton.

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74) Shirley Locke
RR 2
Eddyville, IA 52553

75) Jeff A. Mahieu
Making Homemade Batteries
2029 15th St.
Moline, IL 61265

76) Robert D. Meyers
Energy Sources
1318 Brentwood
Ottumwa, IA 52501

77) Doris Nelson
Alternate Sources of energy
RR 2, Box 161
Mediapolis, IA 52637

78) David Palmer
Awareness of Environmental Problems
802 Oak Park Blvd.
Cedar Falls, IA 50613

80) Bill Rogiers
Conservation & Home Energy
1442 11th St.
Moline, IL 61265

81) Jeanne Rogis
Energy Around Us
RR 2
Dewitt, IA 52742

82) Perry O. Ross
Fossil Fuels
505 W. Clay
Mt. Pleasant, IA 52641

83) Betty Jo Rumer
Consumption of Energy
Box 457
Thornburg, IA 50255

84) Ed Saehler
New Health Technology
1909 Delwood Dr.
Iowa City, IA 52240

85) Robert C. Schiffke
Fossil Fuels
215 N. Rowe Lane
Box 63
Walcott, IA 52773

86) Ernest Schiller
Energy flow & living organisms
RR 2
Donnellson, IA 52625

87) Sindy Stiles
Fossil Fuels
1202 N. 24th St.
Fort Dodge, IA 50501

88) Ralph Stuekerjuergen
9th Grade Science Course
37 Storms Ct.
Fort Madison, IA 50501

89) Janice Thorne
Hot Air Balloon Race
3023 Sweet Briar
Iowa City, IA 52240

90) Gwendolyn Whittaker
826 Orleans
Keokuk, IA 52632

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CHAUTAUQUA
NOTES

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CHAUTAUQUA NOTES

SCIENCE EDUCATION CENTER
VOLUME 2, NUMBER 2 THE UNIVERSITY OF IOWA OCTOBER, 1986

Developing an STS Student Model

We continue to get comments like, "What do you really want us to do?" Basically, we are after your creative ideas and the results of your creative teaching. However, we do want to publish summaries and to collect the results of your efforts in some way. Here we provide the following format for your information and continued use.

Preparation

- Select the STS topic, target the grade level(s) and indicate the proposed length.
- Establish the rationale for the STS topic in the course of study; i.e., social relevance, relatedness to the course of study, appropriateness for the student.
- Make an initial review of resources, articles, materials, people, organizations, agencies, etc. Look for different viewpoints.
- Designate an advisory committee willing to provide support with the content and instructional components of the module.

Module Framework

1. Goals and Objectives
   - Identify the major purpose(s) of the STS module.
   - Develop a working statement of objectives, what students as citizens will *know, do,* and *value* as a result of this module.
2. Conceptual Framework
   - Identify the *STS Concepts* which will be used and re-used throughout the module; for example, systems, trade-offs, wholism, time constants and limits, unintended consequences.
   - Develop the content outline of three to six main ideas about the STS topic.
   - Specify information and facts that will develop the main ideas of the module.
3. Approaches to Sequencing Knowledge
   - Arrange the content outline with some thought to instructional tasks; local to global, concrete to abstract, present contrasted with past practices, simple to complex.

Instructional Component

1. Identify student resources that are the *most relevant.* Include newspaper articles, case studies, and consider rewriting those that need simplifying.
2. There are several instructional design questions to consider in the format:
   - How to *introduce* the STS topic to students so that they clearly see the relationship of technological or scientific developments to the topic's social impact.
   - How will students *analyze* the STS topic? Consider developing questions or a model to focus their search for infomation and decision making.
   - Will you build in some *choices* or must students do all module activities?
3. Provide activities to involve students in the community, gathering data, participating in activities and taking action. Expect students to share their findings and make use of media in their reports.

Writing the Module

- Write the text so that you speak directly to the students. Let them know what they are going to do in the particular section of the module, the purpose, and what the final outcome or product should be.

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Chris Day from Grinnell looks on as (R to L) Myra Moore, Daniel England, and Dave Kust explore the possibilities of making a lightbulb. (Decorah Chautauqua)

How STS Fits Into the Learning Cycle

by Chris Day
Grinnell Middle School

The learning cycle is an excellent guide to incorporate in your STS plan. Here's how you could use it for an STS activity.

A student is allowed to explore after brief explanation with a hands-on type activity. Questioning will generate enthusiasm and interest.

Next, an activity could involve investigating the relationship between a bulb and circuit—discovering how the bulb actually works. First, breaking the bulb which leads into the exploration activity again and the cycle continues.

The application can provide you with additional opportunity to gain insight into how they can apply this new concept to society and technology.

Extension into technology might be exploration into how light bulbs are mass produced. What advances are being made in energy-efficient light sources. This naturally leads into energy conservation, its cost and production. A final area to explore could be careers that are related to your topic. Guest speakers and films are useful in this area.

Next, the teacher and students generalize concepts and formulate principles. This is where the transfer of information meets appropriate results.

The student next applies the concept or skill in a meaningful setting. He sees the relevance of generalized concepts and skills and may develop further activities or formulate concepts which broaden to a societal issue.

To continue the unit on electricity, one might plan as follows: Continue with the concept—what is a circuit?

Plan an appropriate activity based on their past experiences. An activity might be for the students to make a small light bulb light.

Provide time for the exploration—observing and questioning.

Next, plan for invention. How does this light bulb work? Is it actually part of the circuit? Generalize: If electricity moves along a given path, then the bulb must be part of the path also.

You can see how a topic can generate interest and apply to issues with which students can deal.

CHEMCOM—A Reexamination of the Chemistry Menu

Chemistry in the Community, or CHEMCOM, is an alternative chemistry course for the general student at the high school level. General students are those students who do not intend to major in a chemical science at a university—the majority of our students. They certainly shouldn't be classified, however, as the silent majority because these are the very students who, as adults, may become highly vocal about issues in their community involving chemistry. They may understand and appreciate little of either the scope or limitations of the discipline, but they will become the decision-makers who, as tax-paying citizens, will ultimately decide the future.

CHEMCOM is a course where students learn to understand and appreciate chemistry while:

- placing chemistry in its societal context,
- using chemistry to solve everyday problems, and
- recognizing chemistry as a vitally significant human endeavor.

The course is structured around issues in the community involving chemistry. Chemistry is introduced on a need-to-know basis only. Note, however, this is a real chemistry course, not an uneasy hybrid of chemistry and social science that no one would feel comfortable teaching. In a way it could be considered a chemistry appreciation course—a statement made with some trepidation before this group since you wouldn't want to get the notion that the course is the chemical equivalent of "Rocks for Jocks" or "Physics for Poets." These appellations for alternative science courses unfortunately carry with them a negative connotation—a suggestion of lower level, of intellectual inferiority, of undesirablity. Those of us involved with CHEMCOM would argue fiercely that the course is not only intellectually rigorous but challenges students to rise to higher levels of cognition than the more traditional chemistry course.

CHEMCOM students are asked to apply the chemistry they are learning in decision-making exercises that require a synthesis and evaluation of knowledge of some sophistication. CHEMCOM is not watered-down chemistry—it is perhaps a different selection from the chemical menu presented in buffet style rather than as banquet—our students slake their intellectual appetites without getting overstuffed and experiencing indigestion! Too many of our chemistry students leave high school, and college, suffering from a mental indigestion which leads to that often-fatal disease—chemophobia.

It is a cop-out to claim that students who fail or are not attractced to traditional chemistry classes are the lower-level students who aren't smart enough to study *real* chemistry. As argued before, they *are* the majority—perhaps as a result of some purposeful cosmic equilibrium in favor of the non-chemist. These students will run this country—they will become lawyers, politicians, trade union officials, managers of large and small businesses, economists, accountants, voters. Yet, they aren't smart enough to understand chemistry? Poppycock! We, the cooks, need to reexamine our menu.

CHEMCOM is such a reexamination. It presents the students with real world issues and real world solutions to problems. Chemistry is viewed as an evolving, essentially dynamic process through which we enrich our lives, while comprehending at least some of the mysteries of the material world around us.

CHEMCOM examines the issues of water pollution, mineral resource management, use of petroleum as both a fuel and chemical feedstock, personal and world nutrition problems, uses of nuclear energy, the effects of air pollution on air quality and climate, the healthy body as a chemical system in balance, and the role and responsibilities of the chemical industry. The laboratory activities are an integral part of the curriculum, as are the decision-making activities which were referred to previously. Much familiar chemistry is retained, although the students are exposed to less physical and more organic

(continued on Page 3)

(continued from Page 2)

chemistry than in more traditional courses.

At present, the ACS is field-testing the materials in 13 states involving some 3,000 students and 64-plus teachers. The initial responses received from the field test have been very positive—both students and teachers are finding the material to be challenging, the unique presentation to be fun. Incidentally, how many of you think it is inappropriate to have "fun" in the classroom? How many of you know what CHEMCOM means by fun? Fun is defined as the "ah hah" experience in the classroom, that moment when the penny drops and the student has the "I understand at last!" look on his or her face. This is fun for both teacher and student. This moment happens when students are intellectually challenged, become intellectually involved, and have an opportunity to be intellectually playful. Most importantly, students have an opportunity to experience intellectual success.

Does anyone really believe it is inappropriate to allow our students to experience intellectual success in the chemistry classroom?—or any classroom? Yet, too often this is what we do when we try to prepare the majority of our students as if they were all going to become chemists when most of them will not become any kind of scientist. CHEMCOM is attempting to put the intellectual success back into chemistry for many more of our students and, hopefully, with the support of the teaching profession, over the next five years that is exactly what the ACS *will* succeed in doing. They hope, ultimately, to do even more than that, to instill in our students an intellectual appetite that leads to life-long learning and personal fulfillment.

For more information contact:

The American Chemical Society
1155 Sixteenth Street, N.W.
Washington, D.C. 20036
(202) 872-4600

Birthdays of the Scientists

By Amy Bruner

Each month we will publish a list of scientists' birthdays submitted by Sharon Johnston, a teacher from Webster City Jr. High School. Discussion of the scientist and his/her accomplishments could be an excellent way to make science relevant to your students and to incorporate STS into your curriculum. (For example: How did the scientist's discoveries and the resulting technology affect our society?) One possible activity would be to have each student responsible for the birthday of one scientist. They could research the individual (library research), write up a paragraph or short story on the individual (writing skills), and then on the scientist's birthday have them give an oral report to the class. This is just one idea, but there are many other things you could do.

October

1	Otto Robert Frisch
2	Peter Hjelm 1746
	Sir William Ramsey 1852
	Julius von Sachs 1832
3	William Crawford Gorgas
4	Michael Pupin 1858
5	Robert Goddard 1882
6	Nevil Maskelyne 1732
7	Niels Bohrs 1885
8	Henri Le Chatelier 1850
	Ejnar Hertzspring 1873
9	Emil Fischer 1852
10	Henry Cavendish 1731
11	Don D'Elhuyar 1755
	Heinrich Olbers 1758
12	Ascanio Sobrero 1812
13	Robley Williams 1908
14	Sir Edward Sabine 1788
15	Evangelista Torricelli 1608
	Asaph Hall 1829
16	Albrecht von Haller 1708
	George Westinghouse 1846
17	Edouard Roche 1820
18	Christian Schonbein 1799
19	Jean Delambre 1749
	Orville Wright 1871
20	Sir James Chadwick 1891
21	George Ernst Stahl 1660
	Herman Hellriegel 1831
	Alfred Nobel 1833
22	Clinton Davisson 1881
	Karl Jansky 1905
23	Nicolas Appert 1752
24	Anton van Leeuwenhoek 1632
25	Heinrich Schwabe 1789
	Henry Russell 1877
	Richard Byrd 1888
27	Pierre Berthelot 1827
28	Jonas Salk 1914
29	Othneil Marsh 1831
30	Hermann Kopp 1817
31	Sir Joseph Swan 1828

November

1	Balfour Stewart 1828
	Alfred Wegener 1880
2	Harlow Shapley 1885
3	Daniel Rutherford 1749
5	Paul Sabatier 1854
	Leon Teisserenc DeBort 1855
	Fred Whipple 1906
7	Marie Curie 1867
	Lise Meitner 1878
8	Edmund Halley 1656
	Christian Barnard 1922
9	Carl Sagan 1934
10	Andres Del Rio 1764
11	Vesto Slipher 1875
12	John Rayleigh 1842
	Seth Nicholson 1891
13	James Maxwel 1831
14	Robert Fulton 1765
	Leo Baekeland 1863
15	Sir William Herschel 1738
16	Jean D'Alembert 1717
17	Henry Gellibrand 1597
18	Louis Daguerre 1789
19	Mikhail Lomonosov 1711
20	Otto von Guericke 1602
	Edwin Hubble 1889
21	Hieronymus Richter 1824
22	Andrew Huxley 1917
23	Prospero Alpini 1553
	Jahannes Van Der Waals 1837
	Henry Moseley 1887
24	Tsung-Dao Lee 1926
25	Julius Mayer 1814
26	Norbert Wiener 1894
27	Anders Celsius 1701
28	John Hyatt 1837
	Sir Robert Hadfield 1858
29	Christian Doppler 1803
30	Ernst Chladni 1756
	Smithson Tennant 1761

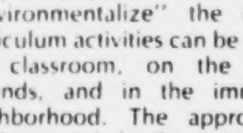
Living Lightly

From the Department of Education newsletter

Living Lightly in the City, An environmental education resource for Grades K-3, 4-6, and *Living Lightly on the Planet*, Grades 7-9 and 10-12.

This curriculum/resource provides children with hands-on activities that will build their understanding of and concern for their environment. The urban environment is viewed, not as a negative, non-wilderness place, but as a place where people can learn to have an influence on their surroundings. The four volumes move from the lower elementary grades where the emphasis is on discovery and enjoyment, to the middle elementary years where transportation, land-use, water, recycling and consumerism are explored. In the Junior and Senior High School books, problems of increasing complexity are studied such as groundwater contamination, toxic wastes, urban sprawl, and diminishing resources. Each volume is divided into several units with individual activities to be infused into the standard subject areas. This interdisciplinary approach is designed to "environmentalize" the existing curriculum activities can be done in the classroom, on the school grounds, and in the immediate neighborhood. The approach is hands-on and the focus is on the students' relationship to the earth. Each unit consists of an introductory sheet highlighting unit topics/activities, lists of concepts to be taught, ways to introduce the unit, student activities, and student activity sheets. Objectives, materials needed, time required, and instructional strategies are provided for each activity.

For more information or to order these books at $12 each (add 60-cent tax if Wisconsin resident and $1.50/each postage and handling), contact: Living Lightly in the City, Schlitz Audubon Center, 1111 East Brown Deer Road, Milwaukee, Wisconsin 53217.



Dave Kust (R) and Dan England (C) put the finishing touches on their homemade light bulb. (Decorah Chautauqua)

Classroom Corner
"More Activities for Classroom Teachers"

Cynthia Lehrkamp has developed a unit for her 5th-grade class where they compare technology of the past with our present technology. Activities included tie-dying T-shirts using natural dyes, learning processes for survival from a mountain man (speaker), and interviewing their grandparents to discover how technology had changed since their grandparents were children. Their final activity was to design the future living style of people in the year 2020.

You can contact Cynthia at the Manning Elementary School in Manning, Iowa 51455.

John Rudisill incorporated STS and Earth Science on an all-day fieldtrip. The purpose of the trip was not only to show students earth science-related sights, but to demonstrate how technology has affected their society. Some of the sights and topics discussed include a detention basin: flooding, recreation benefits, construction used; wind-powered generator: alternative energy sources, cost-benefit ratios; and Pioneer Hybrid Seed Company: effects of technology on corn/soybean production. Each community is full of examples of how science and technology has affected our society.

Contact John at East High School, East 13th and Maple, Des Moines, Iowa 50316.

Sharon Fisher has put together a physical science unit based on "Seat Belt Science," a very appropriate topic since our state legislators recently passed a seat belt law in our state. Topics in the unit include forces in an automobile collision, dynamics of a crash, reaction time and second collisions. The unit includes not only experimentation and math, but also has a values component.

Contact Sharon at Meredith Transitional School, 4827 Madison Ave., Des Moines, Iowa 50310.

When Janice Ziettlow teaches the principles of aerodynamics, she has her students practice their problem-solving skills by designing, developing and experimenting with aerodynamic structures. The result of their handiwork is then entered into a category for competition. Categories include time aloft, distance, aerobatics and aesthetic design. During competition students are required to discuss what features of their plane aided its distance, time aloft, etc.

Contact Janice at Hiatt Transitional School, 1214 East 15th, Des Moines, Iowa 50316.

Make a Splash with Chromatography

by Bonnie Barr
From CESI NEWS, Summer 1986, Vol. 19 No. 4

One of the most remarkable events of fall is the color change which occurs in the leaves of deciduous trees. Change is perhaps the most consistent theme in nature. Change may be either reversible or irreversible. Some changes which appear to be irreversible can be reversed if special tests are performed. Separating mixtures of colored pigments by chromatography is an example of such a change.

Activity 1

Use medicine droppers to add several drops each of yellow, blue, and red tempra paint to the center of an 8½" x 11" sheet of paper. Fold the paper in half and mix the paints by rubbing the paper. Unfold the paper and have students identify the colors that are now present on the paper. Ask the students if they think they can get the green, orange, and purple colors which now appear on the paper back to the red, yellow, and blue. Your question is likely to be met by a resounding "No!". Tell students that sometimes special tests must be used to reverse a change.

Give each pair of students a 1" x 4" strip of filter paper or a paper towel. With a green water-soluble magic marker place a dot about ½" from one end of the strip. Give each pair of students a small baby food jar containing about ¼" of water. Have the students put a toothpick in the top (opposite end from the dot) of each strip of paper so that when the paper is suspended into the jar, only the bottom edge of the paper touches the water.

Water will climb up the paper and dissolve the color. The green dot separates into blue and yellow spots with the blue (less dense) being higher on the paper.

Have the students use chromatography to see into what colors orange, purple, and brown will separate.

Activity 2

Forcefully use the thumbnail to eject a smear of green color from a leaf onto a 1" x 4" strip of filter paper about ¼" from one end. With a toothpick, suspend the strip, smear end down, into a baby food jar containing ¼" of rubbing alcohol. Make sure that only the bottom edge of the strip touches the alcohol. The alcohol climbs the paper and dissolves the green color. The color will separate on the paper into green, yellow, and reddish-brown sports. In the fall the green pigments disappear, allowing the yellow and red pigments to show.

Have students use chromatography to separate the pigments in a fall-colored leaf.

STS Meetings Abound

The Science-Technology-Society approach to science education, commonly referred to as STS, is growing in popularity as educators, administrators, and parents realize the need to teach science in a social context, connecting science to its technological applications and to the social, environmental, and economic impacts of those applications.

Teaching about energy and energy issues almost require this approach, and many long-term energy educators may find all this fuss about STS long overdue. But the increasing national attention should help convert the skeptics and unearth ideas for those of you who (whether you knew it or not) have been blazing the STS trail through the years.

A number of conferences focusing on STS education are scheduled for the coming year. No doubt the largest will be held this February, organized by the Science through Science/Technology/Society (S-STS) program at Pennsylvania State University. The Penn State program is the largest STS effort funded by the National Science Foundation and is profiting from the momentum of last year's tremendously successful Technological Literacy Conference in Baltimore.

Statewide and regional conferences are fertile ground for STS as well. Florida's FAST (Florida Association of Science Teachers) is holding their annual meeting this month (October 16-18) with the theme, "Thinking about Science Technology and Society." Likewise, South Carolina's 11th Annual SC2 Convention is dubbed "Science-Technology-Society" and will be held this November in Columbia.

Researchers Needed

Two Exeter Conferences on school science education have sought the advice of practicing classroom science teachers from all over the country. At each of them teachers ranked science-technology-society (STS) education high on their list of concerns, and the increasing interest in STS today adds force to their conviction that STS material should be made a part of all introductory science courses wherever possible.

Teachers who add STS material systematically to their courses (as opposed to occasional comments and illustrations) are still a minority, however. They tend to be (and to feel) isolated, and they often have difficulty locating appropriate and tested societal and ethical material with which they feel comfortable. Their training as science teachers does not normally help them to deal with value-laden issues, nor is there even today a well-recognized body of knowledge on how to teach such material in a science classroom.

As directors of the second Exeter Conference (June 1985) we are considering a project that will address this need. This notice is intended to invoke your interest and your help.

What's involved? We are considering the formation of small groups of science and social studies teachers in neighboring schools who wish to explore practical ways of teaching STS material. The central question: WHAT WORKS? Each group will be cross-disciplinary but focussed on a limited range of grade levels. Following the successful philosophy of the Exeter Conferences, each group will define its own research protocol, gather

(continued on Page 6)

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materials, and share insights. If a number of small groups of experienced teachers can bring their varied experience and insights to bear on a single common purpose, we may expect significant insights into the teaching of STS material. The varied conclusions of the groups will be analyzed, shared, and published.

We will start small and seek funding for a one-year or two-year project before going further. Our quest for funding will turn on evidence of interest on the part of teachers concerned with the ideals of science-technology-society education. This may well be you!

If you are interested and we are funded, please send a letter to Richard Brinckerhoff. Be sure to include name and school address, grades taught, and teaching experience.

Richard F. Brinckerhoff
Department of Science
Phillips Exeter Academy
Exeter, NH 13833

Future Workshop and Convention Calendar

October 24-25, 1986
ICEC Fall Workshop, "Nature's Kaleidoscope," Ottumwa, Iowa

October 30-November 1, 1986
NSTA Area Convention, Indianapolis, IN

October 31-November 1, 1986
Industry Sponsored Chautauqua, Springbook State Park Conservation Education Center, Guthrie Center, IA

November 7-8, 1986
Industry-Sponsored Chautauqua, Bettendorf, Iowa

November 10, 1986
Project Wild, AEA 7
Cedar Falls, Iowa

November 14-15, 1986
Project Wild, Great River AEA, Burlington, Iowa

November 20, 1986
Make and Take Energy Workshop, AEA 7 Cedar Falls, Iowa

November 20-22, 1986
SSMA Convention, Lexington, KY

November 21-23, 1986
NSTA Convention, Las Vegas, NV

December 3, 1986
Iowa's New Energy Program, AEA 7, Cedar Falls, Iowa

December 4-6, 1986
NSTA Convention, Anchorage, AK

January 16-18, 1987
Winter Solstice, Conservation Education Center, Springbrook

March 17, 1987
Project Wild, AEA 6, Marshalltown, Iowa

March 26-29, 1987
NSTA National Convention, Washington, D.C.

◆◆◆Chautauqua Notes Staff:◆◆◆

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CHAUTAUQUA
NOTES
SCIENCE EDUCATION CENTER
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IOWA CITY, IOWA 52242
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CHAUTAUQUA NOTES

SCIENCE EDUCATION CENTER
VOLUME 2, NUMBER 6 THE UNIVERSITY OF IOWA MARCH 1987

Know Where You Live, and Live There
STS and the Bioregion

As STS begins to assume an integral part in many classrooms across the state and throughout the nation, we can now step back and assess the nature of our programs. Where are they headed? What perspectives are they assuming? How can we improve upon our existing STS programs?

One avenue of exploration that can give direction and help improve STS programs is the perspective of bioregionalism. The term bioregional is relatively new, not more than 10 or 12 years old, but it has opened up alternative (or helped us integrate new and old) territory in science. "Bioregional" comes from *bio*, the Greek word for forms of life, and *regio*, Latin for territory to be ruled. Together, they mean a life-territory, a geographical area where rough boundaries are set by natural phenomena, not human dictates, distinguishable from other areas by characteristics of flora, fauna, water, climate, rocks, soils, landforms, and the human settlements and cultures these characteristics have given rise to. If the concept seems strange, it may be a measure of how distant we have become from the wisdom and insight it conveys.

> *"We all live some place; it's how we interpret the place we live that distinguishes the way we relate to it and controls our actions towards it."*

The first question we must ask of ourselves and our students is: Where do we live? Since the beginning of the industrial age, only about 200 years ago (and only about two or three decades ago for much of the world), the answer to this basic question has been framed in more urban, statist, and technological terms, rather than in those of the process of life itself. Ask the students in your class and expect most of the replies to be somewhat similar to these: in a numbered house on a street; in such and such town; in a state or nation. All of these are, of course, very accurate to a degree, but they do not encompass one of the fundamental premises of our existence.

We all live some place; it's how we interpret the place we live that distinguishes the way we relate to it and controls our actions towards it. The bioregional perspective can help students bridge the gap between society and the natural worlds; it can provide a framework for the study of science-technology-society interactions and their ultimate impact on the local region the students live in.

A bioregion can be interpreted in many ways, some of which would be highly specific such as an area with a specific natural vegetative cover, or it can be a general area such as a watershed, a valley, or a mountain range. In Iowa, we could intrepret our bioregions in many ways also; the Mississippi and Missouri River watersheds are both in our state, as well as numerous local watersheds that drain into our eastern and western natural river boundaries.

Any place is within a bioregion—towns, villages, urban metropolises, forests, lakes, and farming areas are all contained within a specific "region." The northeastern section of Iowa, called the driftless area, with its steep bluffs and forest cover is distinct from the prairie-pothole section of central and northwest Iowa. The loess hills along the Missouri River valley are very distinct contrasted with the rolling hills and river systems of southeast Iowa. So you see, even our "tall corn state" is made up of many natural bioregions which can be explored, investigated and reinhabited.

With the advent of bioregional perspectives, many of our so-called environmental disasters become less frightening and more manageable. For one thing, people don't usually think of themselves as inhabitating a specific region; therefore, they don't have a working knowledge of how to live there. People also *do* know that their region's environment is being assaulted and imperiled (Iowa's groundwater pollution, the disposal of toxic and industrial wastes, landfill dilemmas and other relevant issues come immediately to mind). Most often, people feel these problems are generated by forces they do not understand and cannot control. The notion of environmental health is new in the public consciousness and, thanks to the many problems we now recognize, the public as well as our students can be aroused and actively encouraged to seek solutions. This is where STS and the bioregional perspective meet and form a productive alliance.

Traditionally, science has been presented as a body of knowledge to be mastered, processes to conceptualize, and skills to be developed. The STS approach encourages teachers to move from the traditional approach to a more relevant, local issue-oriented science, a science students can experience, touch, see, smell and feel. One may even call STS a move towards making the use of science meaningful to individuals involved. But, is it meaningful for students in your classroom to study about the far-off effects of acid rain, toxic wastes, or other large-spectrum issues? Can they relate it to their lives? Or, would it be more closely related to the students' needs if they had the opportunity to seek information and explanations about the local regions in which they live, which may in turn bring them to a local perception of the effects of acid rain, toxic wastes...? The phrase "think globally, act locally" can now begin to develop a whole new impact.

"The phrase 'think globally, act locally' can now begin to develop a whole new impact."

There are four central aspects to developing an STS curriculum with a bioregional perspective: 1) knowing the land; 2) learning the lore; 3) developing the potential; and 4) liberating the self.

The initial task is to understand place, to know the land, the specific place in which we live. The types of rocks and soils under our feet; the sources of the water we use; the paths of our refuse, liquid, solid, and gas; the nature of our local weather; the common insects, plants, animals, and landforms; the times to plant and harvest; what types of natural foliage are edible, these are some of the things that help us know our place. The cultures of the people must also be understood—from the early history of the area to the present, including social and economic arrangements of the area and their impact on the region in the urban and rural environments.

Much information is available, and developing a local resource inventory for the region is a great way to start. The local forest service or soil conservation service maps can be used to map the vegetative and forested areas; checking hydrological surveys can determine waterflows, hydropower sites, and runoffs, learning annual climatic conditions and developing estimates of the full potentials of solar, wind, and water power; collecting biological profiles of the area's native vegetation; and studying human land-use patterns and optimal settlement areas and arrangements. Ultimately, people could develop knowledge that would have impact on determining the natural limits of a regions in which sustainable societies could live.

Earlier people, particularly cultures well rooted in the natural cycles of the earth, knew a number of things we through modern science are only beginning to find out. Learning the lore, the history of an area, is a valuable tool in understanding your place. Every place has a history, a record of the human and natural possibilities of the region. This can be studied with a new outlook. A virtual library of information is available if we would recognize its value and begin to use it. From collections of oral Indian lore and folk knowledge, to the values of herbal medicines, methods and time of burning prairies, the location and building of solar houses for maximum gain, the land-use history, and many other natural and human resources, we can gather information useful in our quest of knowing our place.

Within a given region the development of the potential to act in an impactive manner becomes much easier when we begin to know our place. No longer do many of our problems and local issues seem out of our control, we begin to see some logically derived solutions which can be implemented locally. We can try to use the knowledge and experience we accumulate to formulate ways of living within our bioregion. Developing a healthy relationship with our areas can be constrained only by the logic of necessity and the laws of ecology. Acting to improve our regions we are in turn enhancing the quality of our communities and learning that we can have impact. This is a point many students fail to recognize when we present them with their upcoming inheritance of global problems.

The final aspect of the bioregional perspective is very closely associated with the development of the region's potential. In developing the region's potential, we also liberate the individual's potential.

Within a region the students would see their role as contributors to and of being in control of interactions with their immediate environment; thus, helping them shape their own destinies. The phrase, "There is nothing I can do about it," begins to fade into distant memory. Also, working towards an understanding of our regions necessitates a closer connection with our local lands and people. Being connected, almost daily, to pursuits related to our community and the surrounding natural world can help foster the values of cooperation, participation, sodality, and reciprocity which enhance individual development.

The task of developing and integrating our STS programs with a bioregional perspective is obviously not easily accomplished. But, if you think about it, many of us already are doing things we could tag with the label "bioregional," just as we were teaching the STS approach before anyone called it STS. The usefulness of having a label for what we do is it can help us provide a rationale for our actions and develop a sense of direction and purpose for how we are teaching.

For more information on organizations developing bioregional materials for classroom use and general information about the study of bioregions, contact: 1) The Planet Drum Foundation, Box 31251, San Francisco, CA 94131; 2) The Institute for Earth Education, Box 288, Warrenville, IL 60555; 3) Sunrock Farm, 103 Gibson Lane, Wilder, KY 41026.

And don't forget, everything is connected to everything else.

Paul C. Tweed
Editor

Emerging Principles for Successful STS Efforts

by Robert Yager

It seems clear that teachers who experience STS with the most success have approached it from some perspectives that encourage such success. These perspectives include:

1) There is no set of concepts which all students should know and which must be possessed prior to involvement with a problem.
2) There is no student (even though some seem so) who is devoid of all interest in his/her surroundings. The trick is to demonstrate that you (the teacher) are really interested in each student and his/her interests. Many students have had previous teacher/school experiences and are convinced that teachers/schools have agendas that don't care about each student.
3) There are multiple ways of accomplishing almost any task. A premium can be put on innovative procedures and thinking. Such divergent views and procedures bring a richness to the class setting. They can also excite teachers in a variety of ways. The pressure is off being the dispenser of information, the organizer, the judge, the jury, the policeman, the worker (preparing instructional/laboratory materials).
4) Ideas and questions arising from current events are more captivating and timely than the next page or chapter in a textbook. Other considerations of issues can lead teachers and students to textbooks for *needed* information.
5) Success often means working directly with parents, community resource people, and school administrators. Success with STS does not come from doing it alone and expecting everyone else to be in awe. Success means building a community of support and involving as many people as possible in the activities.
6) There is nothing wrong with the lack of closure. Most important questions are not "yes-no" types. Problem resolution is better than problem solving. Science by definition is self-correcting, and all knowledge is temporary. So should it be in a successful STS classroom.
7) Efforts/experiences in the STS classroom need to be connected to other school/home daily living activities. Work on real problems can not be contained in one classroom, demonstrated by one teacher, for one or more class sessions called science.
8) Successful STS situations involve much student and parent feedback. Evaluation must be viewed as more than testing—and more than scores on typical standardized and/or teacher examinations. Invariably, these focus on knowledge and ignore the other important domains for science and science education.

Mark October 9-10 on Your Calendar

We are anxious that all Iowa Chautauqua participants from 1984-87 (a total of 250) attempt to get to Cedar Rapids on October 9-10 for the "first" Annual Chautauqua Fall Conference. We want everyone to have continuing opportunities for dialogue about STS and to display new modules and demonstrate new approaches.

We hope that the effort will be endorsed by the State Chamber of Commerce and that local chamber support can be attracted to help with teacher registration, travel, and lodging costs.

Exciting state and national leaders will headline the major sessions. Every Chautauqua participant will leave with display and sample activity demonstrations. One or more teachers will be selected for special recognition with an expense-paid trip to 1988 NSTA meeting.

We hope you are as excited as we are with the Fall Conference plans. We are delighted that the Iowa Utility Association will be providing the major support for this event, which will allow us to remain in closer communication.

STS Program Funded as Supplement to Iowa Chautauqua Program

Dr. John Penick has been awarded a new three-year grant from NSF to help with STS efforts in Iowa. This effort will expand from the STS efforts already underway as a result of the Honors Workshop.

Sixty teachers from grades four through nine will be involved in in-depth short courses in applications of biology, chemistry, physics, and earth science for six days during the summer. Twelve STS teachers from past efforts will also be involved sharing their successful experiences. These twelve teachers will remain on campus a second week as specific plans for the academic year's programs are finalized.

Another 60 teachers (colleagues from the same schools as those represented by the 60 teachers in the summer) will be added to the Chautauqua-type courses in the fall. A total of 120 teachers will thereby be involved in introducing STS modules into their 4-9 science programs. Short courses will be held for two days at four sites in Iowa during October. An additional day will be arranged (a Saturday) during the interim. A second two-day workshop will be held in the spring at the same four sites to allow teachers to share the results of their STS experiences. First reports of the modules and evaluation reports with student data will be completed at the end of June—prior to a new cycle for 1988-89.

We all look forward to many challenges of this "Iowa" effort.

Technology as a Connection

by Doug Ross

The last issue of *Education Leadership* included another "Trends" column authored by Dr. Robert Yager of the University of Iowa. It is easy to see this "trend" as one that all Iowa Chautauqua participants are a part.

Basic to the article is the overview of recent trends in science curriculum content and the changes research seems to be calling for. In the past two decades, science teaching has been dominated by a movement which sought to interest students intrinsicly by presenting science reduced to the basic concepts and theories essential to each discipline as accepted by mainline scientists. Technologies, applications, and relevant issues in science were removed from the curriculum, and students were forced to learn of technology and real-world issues in other arenas.

Research data suggest that these science programs did not attract more students, nor did they meet any objectives other than standard achievement and may have actually worsened student attitudes toward science (Yager and Bonstetter 1984, Yager and Yager 1985).

Recent studies suggest that technology and its related issues hold more interest for students than does basic science; conversely presenting science in its purest form in producing less-motivated students (Voelker 1982). According to Yager, "We should not assume that students cannot appreciate and understand technology without their first understanding basic science. When students deal with technological devices or problems arising from technology, such a context provides concrete examples, built-in motivation, an action component, and a relevant real-world dimension. Within that environment, skillful teachers can lead students to appreciate the crucial role of science in understanding devices we encounter in daily living and in resolving specific problems. Instead of teachers and textbooks expounding on the importance of knowing basic science, students seek out the knowledge because they first see the need and the value of such information through direct experience."

The article concludes with examples of schools utilizing these ideas in programs dealing with real problems associated with dried foods, solar energy, air pollution in closed rooms, toxic wastes in the community, and heavy metal pollution in the home. These programs are also providing students the opportunity to interact with parents, community leaders, and school personnel, cultivating their science experiences far beyond that of a textbook, a science classroom, and the expertise of a single teacher.

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Ignorance, a Good Place to Start

by Robert Yager

A major problem has been identified with the typical high school science teacher. The "typical" teacher is reported by only 15 percent of his/her students to ever admit to not knowing. Eighty-five percent of all 11th-grade students feel that their science teacher never admits ignorance—that he/she knows all.

Research also illustrates that most students (75 percent on the average) will report observations predicted or provided by their teachers, even when the observation is false. Experiments where teachers have purposefully given erroneous information invariably illustrate the power of the teacher—power stronger than actual student observation of nature. This is an alarming situation for the school environment—particularly alarming for the *science* class.

One of the exciting discoveries of our studies of exemplary science programs is the fact that half of the students report that their science teachers freely admit to not knowing. These science teachers are seen as people who are curious, or are not ill at ease in a situation where they do not know. This is an extremely important point for successful STS teachers.

In an STS setting, the teacher is a facilitator, a guide, a co-investigator. He/she is not the answer-place, the source for all knowledge, the guard to assure coverage of the important knowledge, the determiner of the knowledge students must possess to pass the examination the teacher decides to give.

Ignorance is the starting point for science. The scientist becomes curious about something he/she does not know. Actions are then taken to lead to some knowledge and less ignorance. If questions—those without quick and obvious answers—can be used as places to begin, STS science is in evidence. If information is needed from a variety of sources, STS is in evidence. If we begin with ignorance (the lack of knowledge), but move toward knowledge, we have evidence of successful STS teaching. In fact, the lack of teacher knowledge but the willingness to model doing something about it is the way an excellent teacher can provide a model of real sciencing.

Corner

Joan McShane
Jefferson School
Davenport, Iowa
4-6th Grade Science

Commercial Toilet Tissues and Their Effects on Water Flow and Pollution

In this unit, students explore the following questions: How does a toilet work? Which commercial drain openers work best? How do these products pollute the water in and around Davenport? Does cost affect the product quality and its ability to dissolve? Which products should be purchased to meet the water-quality standards and household needs of the area? The class discusses what they already know about paper products, chemicals, and pollution, and what they need to know so that they can intelligently and wisely choose the best products. Using a real, working toilet, installed by a plumber, the class performs experiments to determine the best drain opener to use on a plugged toilet. Finally, the class visits the Davenport Sewage Treatment Plant to learn about sewage treatment.

Norma Jones
Mark Twain Elementary
Bettendorf, Iowa
5th Grade Health

Nutrition

The students examine sources of principal nutrients, functions of food in meeting life-long body needs, the components of a balanced diet, and potential influences on nutrition. Students compare various diets according to nutritional requirements of individuals, and they interpret physical and mental consequences of a poorly balanced diet. Students study the different methods of food preparation including preservatives, microwaves, convenience foods, canning, fertilizers ... Lastly, students examine world problems of population and crop production as related to nutritional health.

Keitha J. Herington
Garfield Elementary School
Oskaloosa, Iowa
5th Grade Health

Our Bones and Muscles

The proposed length of this two-part unit is 12 days. For each part a learning center is developed and used as a growing display. Students see films on bones, discuss bones from the chapter in the text, learn at least 23 main bones in the body, and develop questions to ask a chiropractor. During part two, "Muscles," students watch films, do experiments on muscles, invent a device that society could use that would help people with bone or muscle problems, and develop questions to ask an athletic trainer.

Science Technology and Society

Making the Science Classroom and Lab Accessible to Students with Disabilities

The accomplishments of more than 1000 working scientists with disabilities and the historical contribution of such disabled scientists as Albert Einstein, Charles Steinmetz and Thomas Edison attest to individual strategies for overcoming barriers in the laboratory and science classroom. Most schools and colleges have made some effort to provide accessible labs and classrooms, making the pursuit of education and careers in laboratory sciences a completely viable option for interested disabled students. There are now many acceptable, cost-effective ways to make laboratories and science classrooms accessible.

The HEATH Resource Center operates the National Clearing-house on Post-secondary Education for Handicapped Individuals and serves as an information exchange about educational support services, policies, procedures, adaptations and opportunities in many educational centers. The following resources are just a few taken from the HEATH fact sheet entitled "Access to the Science Lab and Classroom." This fact sheet was prepared to encourage high school and post-secondary student, faculty members and administrators to recognize the problems, solutions, and rewards of providing laboratory access.

American Association for the Advancement of Science (AAAS), Project on Science, Technology and Disability, 1333 H Street, NW, 10th Floor, Washington, DC 20005. Focuses attention on the need for improved science career information and education for physically disabled youth.

Database resource titled "Resource Directory of Scientists and Engineers with Disabilities." This directory lists biodata on scientists and engineers with physical impairments. These scientists have identified themselves as willing to serve as advisors to disabled students and as consultants on a variety of subjects. Requests for referrals from the database can be made by writing or calling AAAS.

"Scientific and Engineering Societies: Resources for Career Planning," Editors, Virginia Stern and Martha Ross Redden, 1980. This publication offers counselors and students an overview of the wide range of career possibilities and the level of education required in science and engineering based on information provided by 82 professional societies. To order, prepay $6 to AAAS Sales Dept. at the address above.

National Science Teachers Association (NSTA)

"Science for the Handicapped: An Annotated Bibliography." This is a source of articles written through 1980. For more recent articles, NSTA will provide an updated supplement. Write to NSTA, 1742 Connecticut Ave., NW, Washington, DC 20036.

You can receive the HEATH fact sheet free of charge by writing to: HEATH Resource Center, One Dupont Circle, NW, Suite 670, Washington, DC 20036.

Awareness Wheel

by Ann Johnke

To become more aware of the energy usage around us, we must be able to communicate about energy. Developing an "Awareness Wheel" can aid in learning how to communicate knowledge of energy (or any topic). The Awareness Wheel will be composed of five areas as shown in the diagram.

1. Facts or Sense Statements:

Making sense statements is the skill of describing what you *see, hear, touch, taste,* and *smell.* It's the skill reporting on the sense data you receive. The essence of making a sense statement is being specific. The more specific the sense statement, the more useful it is.

Sense statements provide descriptions of situations from the past, report observtions about the present moment, or anticipate future cues. In doing so, they supply data to "what," "where," "when," "how," and "who" types of questions.

2. Thoughts, Interpretations, Perceptions

Interpretive statements can be made simply by saying *what* it is you're thinking, believing, assuming, . . . They need not be vague, general, illusive; rather, they can be clear, concise, and focused if you experience them this way. Be careful, though, to speak about your own awareness, to identify your thoughts as being your own. Disclosing interpretive statements by speaking for yourself, you are saying to your environment:

—This is my thinking at this point in time and is subject to change with new data.

—I'm examining and testing interpretation with my own experience (awareness). They are situation-bound and not true for all time.

—I'm appreciating my own uniqueness rather than my rightness and wrongness.

—I am in charge of my own meanings—I can see and propose alternative meanings too.

—Finally, my interpretation of a situation is not the way the world *is,* it's the way I am organizing what I see and hear at this point in time.

3. Making Feeling Statements

In order to make feeling statements, it's important to begin by recognizing that the feeling is yours—that it belongs to you. *Recognizing your own feelings is the first step.* Simply say, "I feel . . ." or "I'm . . . ."

4. Making Intention Statements

Intention statements let others know what you want short range or long range. Statements will begin with "I want . . . I'd like . . . I intend . . ."An intention statement is a way of being *direct* about what you would or would not like for yourself, or about what you would or would not like to do.

5. Making Action Statements

Making action statements simply involves describing your actions, your behavior to others—what you have done, are doing, or will do. An action statement puts words to some of your behaviors in a simple, descriptive way and are often expressed using "being" verbs—was, am, will.

Action statements also let other people know that *you* are aware of your behavior. Disclosing awareness can be a way of saying that I care about the impact my behavior has on the environment. It's one way of saying, "You're important to me."

Action statements about the future are particularly important because they *involve commitment* to doing or not doing something. Making a future action statement means you let others know what can be expected from you. By carrying out the action, you can increase trust by showing reliability.

Awareness Wheel Exercise

After becoming familiar with the five communication skills, we are ready to start applying them. The following illustration is helpful in understanding how we communicate from ourself through the five skills to an interaction with our environment. The self within us may have a topic, issue, conflict, or anger to communicate with the people, animals, machines, objects in our environment and we do it as follows.

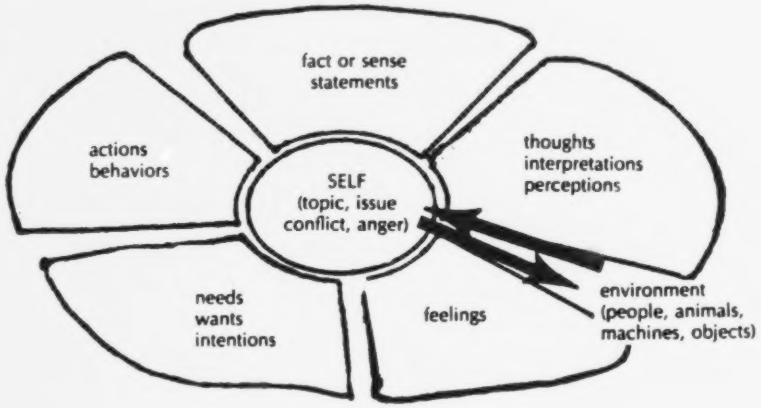
Use the following for a worksheet before beginning your wheel.

MY TOPIC IS:

1. FACT STATEMENTS. What did I sense—hear, see, smell, feel, say?
2. THOUGHTS, INTERPRETATIONS, PERCEPTIONS. How did I interpret the facts?
3. FEELINGS. What did I feel—what was my emotional reaction.
4. INTENTIONS. What did I intend, want, or need?
5. ACTIONS. What did I do? What was my behavior or actions?

PROBLEMS:

Your family has decided to purchase an ulterior energy source to heat your family room. The sources they are considering are solar panels, a kerosene heater, a wood-burning stove, or a fireplace. Choose one of these heat sources, do some research and investigation, and show how you would communicate your awareness about your chosen heat source.


fact or sense statements
actions behaviors
thoughts interpretations perceptions
SELF (topic, issue conflict, anger)
needs wants intentions
feelings
environment (people, animals, machines, objects)

Iowa Chautauqua

Storm Lake Project Updates

Name/Address	Project
Larry Beeson North High School Sioux City, Iowa Grades 9-12	**Biomedical Concerns—Medical Technology**
Judy Bierman Webster Elementary School Cherokee, Iowa Grade 4	**Energy Present and Future—Alternatives**
Karen Bleeker Sheldon Christian School Sheldon, Iowa Grade 5	**Energy Knowledge and Awareness**
Beth Bretthauer Boone Valley School Renwick, Iowa Grades 3-4	**Fossil Fuel and Natural Resources**
Steve DeRocher Eastwood Middle School Cushing, Iowa Grades 6-8	**Basic Science (Plant Problems)**
Hugo C. Denker Dennison Middle School Dennison, Iowa Grade 8	**On Principles of Flight**
Larry K. Eckard Clay Central School Royal, Iowa Grade 8	**Invention/Water**
Bob Fertig Woodbury Central School Moville, Iowa Grades 6-8	**On STS Class Comparisons**
Linda Fiske Eastwood School Cushing, Iowa Grade 5	**Electricity and Alternative Energy Sources**
Pat Fredrickson Webster Elementary School Cherokee, Iowa Grade 4	**Energy Present and Future—Alternatives**
Marjorie Frisbie Roosevelt Middle School Cherokee, Iowa Grade 6	**Awareness of Energy Conservation within a Community. Consumer Education**
Randy W. Graff Spirit Lake School Spirit Lake, Iowa Grades 8-9	**Human/Health/-Disease**
Lisa Holtze Washington School Sioux City, Iowa Grade 5	**Energy Unit**
Ann Johnke [illegible] Central School Royal, Iowa Grades 9-12	**Conservation: Heat, Electricity, Water (Energy Useage)**
Mike Kobliska Boone Valley School Renwick, Iowa Grades 3-4	**Conservation**
Eric L. Larsen Anthon-Oto School Anthon, Iowa Grades 9-12	**Cancer**
Harley R. Lehman Webster City Jr. High School Webster City, Iowa Grade 8	**Acid Rain**
Harlan Meints Charter-Oak-UTE School Charter-Oak, Iowa Grades 7-9	**Machines**
Sheree Pandil Fair Oaks Middle School Ft. Dodge, Iowa Grade 6	**Fossil Fuels, Electricity, Alternative Energy Sources, Energy Patrol, and Energy Exposition**
Nancy Parrott Meridan—Cleghorn Comm. School Meridan, Iowa Grades 5-6	**Fossil Fuels and Alternative Energy**
Rebecca Phipps Roosevelt Elementary School Cherokee, Iowa Grade 5	**Inventions**
Edna Tonner Sanborn Community School Sanborn, Iowa Grade 4	**Conservation and Pollution**
Harold Troyer Gilmore City-Bradgate Schools Gilmore City, Iowa Grades 5-6	**Energy—Past, Present, Future Conservation and Alternate Sources**

Editors Note: The February issue of Chautauqua Notes—Vol. 2, #5 was mistakenly labeled January, Vol. 2, #4. This was because of a small error due to the weather.

Iowa Electric Plans Science Seminar

(with emphasis on Health Physics)

November 14, 1987
IE Tower, 6th Floor Auditorium
Cedar Rapids, Iowa
8:30 a.m. - 4:30 p.m.

Iowa Electric is sponsoring a one-day seminar in the IE Tower 6th floor auditorium on Saturday, November 14, from 8:30 a.m. to 4:30 p.m. There will be preregistration to limit attendance to the seating capacity (100) of the Reddy Room for a catered lunch, but no registration or lunch charge.

Registration will be carried out in cooperation with the three Area Education Agencies.

The final portion of the program is to be a "Hands-On" opportunity for the teachers to use Geiger counters and other health physics equipment at several work stations, planned and directed by Training Center personnel. During this time, the teachers would tour the System Control Center in a series of small groups.

PURPOSE: 1) To broaden the inclusion of energy information in the science curriculum through teachers' understanding and involvement; 2) To foster a positive attitude toward electric energy production.

OBJECTIVE: To hold a one-day Science Seminar to present information about the generation of electricity, with emphasis on those considerations unique to nuclear power plants.

TARGET AUDIENCE: Physics, chemistry, biology, and natural science teachers in schools served by the Area Education Agencies located in Cedar Rapids (Area X), Marshalltown (Area VI), and Waterloo (Area VII).

STS Modules

The second National Technological Literacy Conference was held in Washington, D.C., last month. Nearly 800 STS enthusiasts from across the U.S. were in attendance. This number doubled those involved during 1986. The conferences were quick to sense the international impetus for STS and openly discussed the problems associated with school and college science teaching with focuses on knowledge only.

Emphasis included our nation's schools and colleges introducing new courses and programs to assist students in grasping the technology-laden issues shaping their lives; technology, like the arts and sciences, is a rich field for human imagination. The accelerated pace of technological change outstrips the abilities of both citizens and lawmakers to remain abreast of technology-laden issues.

Chautauqua Notes Staff:

Editor:	Paul Tweed
Contributing Editors:	Robert Yager Jack Clark
Copy Editor:	Betty Dye
Photo Editor:	Doug Ross

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Future Workshop and Convention Calendar

September 24-26, 1987
NSTA National Convention
Salt Lake City, UT

October 9-10, 1987
Annual Fall Chautauqua Conference
Cedar Rapids, IA

October 15-17, 1987
NSTA AREA Convention
Miami Beach, FL

November 5-7, 1987
NSTA Area Convention
Pittsburgh, PA

November 19-21, 1987
NSTA Area Convention (and CAST)
San Antonia, TX

Chautauqua Follow-up Meeting

May 1-2, 1987
Springbrook State Park
Guthrie Center, IA

The course number for this year's Chautauqua short courses is 7S:251—Preparation of Curriculum Materials in Science, for 3 s.h. credit.

Birthdays of Scientists

April

1 William Harvey 1578
2 Francesco Maria Grimaldi 1618
3 Hermann Vogel 1842
4 Joseph Delisle 1688
Sir William Siemens 1823
5 Walter Sutton 1877
Joseph Lister 1827
6 William Miller 1801
James Watson 1928
7 Melvin Calvin 1911
8 Johann Schweigger 1779
9 Charles Steinmetz 1865
10 Paul Herouh 1863
11 Marcedonio Melloni 1798
Bruch Heezer 1924
12 Georges Urbain 1872
13 Sir Robert Watson-Watt 1892
14 Christian Huygens 1629
Hans Oersted 1777
15 Friedrich Struve 1793
Leonardo Da Vinci 1452
16 Wilbur Wright 1867
Joseph Black 1728
Ernest Solvay 1838
17 Giovanni Battista Riccioli 1598
18 Mauric Goldhaber 1911
19 Gastav Fechner 1801
Glenn Seaborg 1912
20 Phillippe Pinel 1745
21 Percy Bridgman 1882
22 Luigi Palmieri 1807
Immanuel Kant 1724
23 Max Karl Ernst Ludwig Planck
24 Jean Marignac 1817
25 Marchese Guglielmo Marconi 1874
26 Sir Owen Richardson 1879
27 Samuel Morse 1791
Wallace Carothers 1896
28 Francis Baily 1774
Jan Oort 1900
29 Forest Moulton 1872
Harold Urey 1893
30 Claude Shannon 1916

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CHAUTAUQUA NOTES

SCIENCE EDUCATION CENTER
VOLUME 2, NUMBER 8
THE UNIVERSITY OF IOWA
JUNE 1987

STS Classroom Characteristics: Before and After

by Paul Tweed

The school year has come to a close! I trust all are ready for that rejuvenation we call summer vacation. As we begin to let 1986-87 fade into memory, hopefully saving the successes for future use and learning from our failures, we are looking towards the next group of students and the next school year. Sadly, for those of us who enjoy the beach, camping, vacations, and summer inservices, September will arrive all too soon. The question is; Will we be ready?

Judging by the products received from this year's Chautauqua participants, much new and exciting teaching and learning has taken place around this great state (and over next door in Illinois). By the way, those of you who haven't sent in your final project or your outline had better hurry up; the deadline approaches.

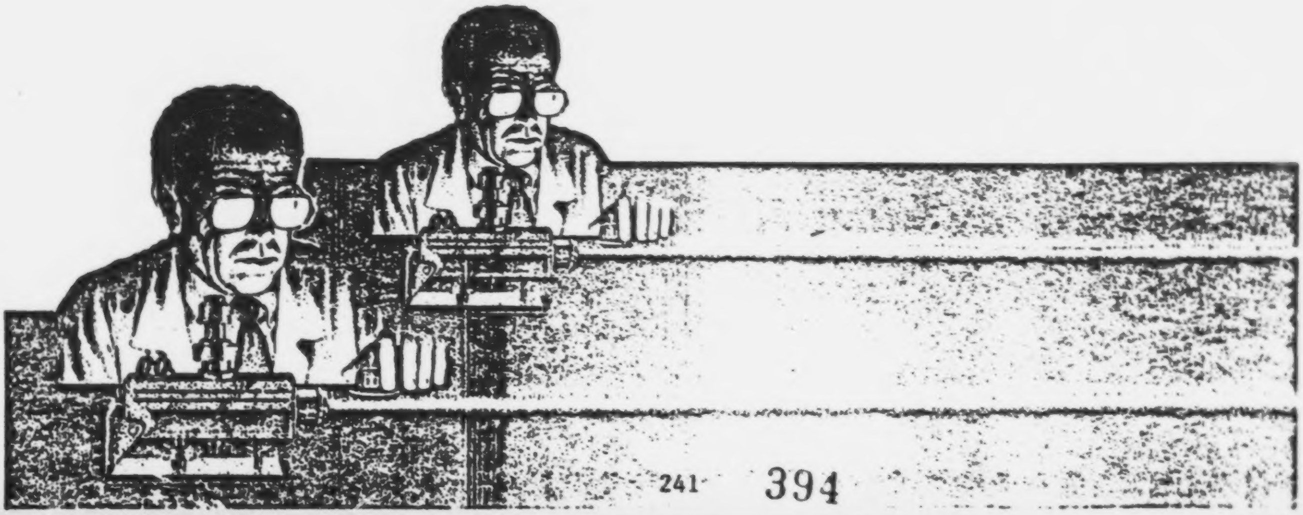
Anyway, most of our 1986-87 group has had a taste of STS and how it can positively affect science teaching and learning.

This brings me to the point of this article. During the spring follow-up sessions, an activity called "Classroom Characteristics Before/After" was conducted at three of our locations—Springbrook, Bettendorf, and Storm Lake. This activity took the form of a discussion in which the teachers pointed out changes in their behaviors, the students' behaviors, and any other noticeable change in the science program brought about by the introduction of the STS philosophy presented at the fall Chautauquas. These activities were facilitated by different leaders at each site so as to insure no leading questions or directing to illicit correct or expected responses. So, therefore, each group generated an independent list of before/after characteristics.

The intention of this exercise was to "find out" (here we go again, investigating something) if there are any universal attributes of an STS curriculum, or characteristics which apply to most, if not all, STS teaching/learning situations.

Since each list (see lists one, two, and three) was generated by a separate group of teachers led by different individuals at each site, and each group of teachers was comprised of a variety of individuals from schools of all sizes and locations, it is safe to postulate that the changes brought about by the introduction of STS occur generally in nearly all 70 schools involved in the experiment.

From the responses of the teachers, STS science opened up options for the classroom that were non-existent before.



Characteristic: Before and After S/T/S

Before	After
Bettendorf Chautauqua March 13-14, 1987	
1. Teachers were dependent on text and manuals for activities and unit material	1. Teachers became less dependent on text and manuals for material and followed the concerns of the student. Increased teacher resource knowledge (awareness and usage of them)
2. Students bored, unmotivated	2. Hard to turn kids off: Increased motivation and interest—some kids staying after school to work on projects
3. Teachers were one-way disseminators of knowledge	3. Students finding knowledge and information. Teaching more of a facilitator two-way communication of information via effective questioning
4. Class seemed to generate little interest in science	4. Students bringing in ideas and questions to investigate
5. Science was "only" science from the book	5. Integration (cross-disciplinary): easy to incorporate other disciplines involved in science (read/write/graph/etc.)
6. Labs consisted of following recipes with little input from students	6. Students designed and carried out labs
7. No real application of knowledge conveyed in class	7. More realized application of science and increased interest in science application with responsibility
8. Little contact with people outside school	8. Definite increase in community involvement and respect for community service personnel
9. Parents only seen when conferences called	9. Increased parental interest in what is going on in school; they are involved with students
10. Class becomes routine and sometimes dull	10. Increased teacher/student enjoyment through discover learning
Storm Lake Chautauqua February 27-28, 1987	
1. Time for science class; get out books	1. Eager enthusiasm; students begin work
2. Children falling asleep with traditional worksheets and books	2. More motivation and student-initiated activity
3. More "formal" approach	3. Use of imagination and equipment
4. Hated science and weren't going to do anything	4. Favorite subject now
5. Low achievers did poorly	5. Low achievers were involved; raised grades
6. Poor attitude in many students	6. Students have better attitudes towards class
7. Behavior problems	7. Behavior problems subside change of "heart" and mind
8. Teachers felt uncomfortable when saying, "I don't know"; teacher as "expert"	8. Teachers felt comfortable telling students, "I don't know, but let's do some research"; students as "researchers"
9. Little active involvement by students	9. Much investigation and challenges; students involved in class
10. Go through motions—take notes	10. Bring in newspaper articles, current topics, news items, students initiate study and investigation
11. Students felt science was a worthless use of time	11. Students developed a sense of pride in their class and accomplishments
12. Many parents' attitudes: "That's why I send you to school! Let teacher teach you!"	12. Parents are learning and are positive; they are active participants
13. Experiments/projects: "Why should we try? It won't work anyway!"	13. Failing as well as successes can occur
14. Science was isolated	14. Integrate science in all curriculum areas
15. Other teachers have set routines and stay in their "own" classrooms	15. Other teachers are involved; team teaching and cooperation is greater
16. Only use *one* science book and certain *core* units	16. Other resources, tapes, kits, made own skits, newspapers, guest speakers, etc.
17. Definition/vocabulary memorization	17. Terminology can be incorporated intuitively as needed

18.	Very few read newspaper, magazines, listen to news, etc.	18.	Discussions on current societal issues; students brought in activities on their own
19.	"I hate going to labs"	19.	"I wonder what we get to do in lab today"
20.	Have to do worksheets and tests	20.	"Hands-on" activities and real investigations
21.	Limited amount of space, equipment, etc.	21.	Still *need* more space for projects, activities, etc.
22.	"Could we have longer to do the project?"	22.	Project deadlines met earlier
23.	Grades easier to give (daily grades and tests)	23.	Determination of grades is more difficult
24.	Students in own "comfortable, non-talkative" world	24.	Cohesiveness between all students—cooperation interaction between students occurs on its own

Springbrook Chautauqua May 1-2, 1987

1.	Use of textbook	1.	Student-oriented ideas with supplemental use of textbook
2.	Textbook tests	2.	Criterion-referenced tests and/or textbook tests
3.	Boredom	3.	High-level interest and enthusiasm
4.	No money for equipment	4.	More money allotted in budget
5.	Little to no community involvement	5.	Lots of use of community resource people
6.	No one reads newspaper, articles, etc.	6.	Students and teaches "need" more current events—share materials
7.	No awareness	7.	Everyone's aware
8.	Elementary people have little or no idea of what junior high/high school teachers are doing (or even care)	8.	Teachers sharing ideas across their curriculum
9.	Low test scores	9.	Higher student achievement
10.	Students/teachers stifled by information	10.	"Creative," "imagination" type of learning
11.	Book-oriented instruction	11.	New or current societal issues being incorporated into book/text information and/or factual knowledge
12.	Too much teacher-time preparation	12.	Teachers don't have to know all the answers (us of students and/or community resources)
13.	Teachers didn't give students credit for what they knew	13.	Student appreciation and credit given for their knowledge
14.	Little or no administrative support	14.	Administrators visiting as well as asking questions
15.	Teacher spoon-feeding information to students (some teachers would never say "I don't know!")	15.	Students doing the researching, teacher says "I don't know!" or "Let's find out!"

By examining the lists generated by this year's Chautauqua groups, one can begin to see the many advantages for the students and the teachers.

From the responses of the teachers, STS science opened up options for the classroom that were non-existent before. Students became much more involved with the investigative aspect of science, so much in some cases that they were "doing science" outside of the classroom—with no assignment! Motivation and interest increased among most students as they worked with issues, problems, and subjects which have a tangible application to their own lives. Cooperative behavior among students increased as the barriers of ability grouping fell to group activities. Most importantly, students learned from failures as well as successes as they experienced a more accurate science, instead of the traditional text-oriented science.

From the perspective of the teachers, texts became less of a crutch and more of a resource. The planning of lessons and explorations became easier as the students became involved. Teachers became more of a facilitator for science than an expert, while their support networks increased to include administrators, parents, and local "experts." Science became integrated across the curriculum as teachers were less concerned about discipline and behaviors because students were active participants in learning using reading, writing, math, and speaking to accomplish projects in science.

As we look toward the next series of Chautauqua short courses and our fall conference, work can be done to verify the results of this experiment. But, judging from the result presented here, many of the changes which occurred in classes involved with this program have begun to take science away from the stuffy, old text-oriented approach and put it in the hands of the teachers and students to explore, inquire, fail, succeed, and learn that science is not only a fun way to experience our environments, but it can help us create changes for a better tomorrow in our communities.

Investor Owned Utilities and Educational Programs

(adapted from a speech)

John M. Lewis President, Iowa Utility Association Des Moines, Iowa

The following article is the next installment in the series written by the Iowa Utility Association members, our major sponsor. This article is adapted from a speech given by John M. Lewis, President of the Iowa Utility Association at the Governor's Conference of Science, Mathematics and Technology Education on February 27, 1987.

Governor Branstad, Dr. Benton, Dr. Glass, Marlene Hill, Ladies and Gentlemen. We're very pleased to have been invited to participate in this Governor's Conference on Mathematics and Science Education—A Shared Responsibility. First of all, a word about the Iowa Utility Association. Our membership consists of the investor-owned gas and electric utilities in the state of Iowa. You know them as Interstate Power Company, Iowa Electric Light and Power Company, Iowa-Illinois Gas and Electric Company, Iowa Resources, Iowa Public Service Company, Iowa Southern Utilities Company, Peoples Natural Gas Company, Union Electric Company, and Great River Gas Company. We supply about 80% of the electricity and natural gas used in Iowa. This responsibility carries with it a great commitment to the state and its future. With the possible exception of agriculture, probably no other industry is as inextricably intertwined with the future of Iowa as is the utility industry. Others may elect to take their money from the banks, sell their buildings or redirect their activities by relocating in another part of the country or the world. That is not the case with utilities. Our commitments are long term and they are permanent. Once a pipeline has been placed in the ground or an electric generating plan has been constructed, it is not about to be moved. Therefore, as Iowa goes, so goes our industry, and I might add that we have every intention of seeing the arrow denoting economic activity and a better life for Iowans go up instead of down.

The fabric of a quality life includes threads of many colors and textures. Of great importance in the weaving of that fabric are the threads of economic development which forms its stability and strength. Our industry for decades has played a major role in encouraging and supporting various forms of economic development in the state. It seems only yesterday—in fact it was just yesterday—that we hosted a state-wide conference on economic development in this very meeting room. Attending were about 600 Iowans from virtually every walk of life who have one basic objective in common—creating jobs and building a strong network of businesses and industries to support a quality life in Iowa.

This fabric also includes the important threads of education, and we share the belief that "excellence in education" is the foundation for economic development in the future. As important as brick and mortar and highways and all of the other elements of our state is that of education. If there ever was a time when business could survive without highly educated workers, it has long passed. A quality life will be supported by quality jobs created by quality industries, and every phase will be supported by quality education.

In preparing to discuss "functioning Iowa alliances," I thought it of value to look at the definition of the term "alliance." I found that it includes "the state of being allied, a bond or connection between families, states, parties, or individuals, or an association to further the common interest of the members." It seems to me that this is a most appropriate term to use in discussing this subject today. All of us certainly do have a common bond and a reason to join in such an alliance. Certainly business cannot proceed without education, and by the same token, education cannot proceed without business to produce jobs, an adequate tax base, and the vitality which every economy must have to sustain itself.

As we discuss business involvement with education, let me recognize a sensitivity which can exist when business becomes involved in supporting education. Some people are quick to call "foul" and claim that business is only interested in supporting its own objectives. We are aware of such allegations, and have gone to great lengths to assure that programs in which we have been involved are objective and unbiased and provide teachers and students with a full spectrum of materials and concepts to be utilized for their own classrooms. It is extremely important that educators have an active role in the program and that they subject it to their professional standards.

Our alliance with education has taken many forms and offers some obvious examples of varying working relationships. The first example involves our relationship with a distant university. For a number of years in the 1970s, we sponsored a student assembly program conducted by the Oak Ridge Associated Universities of Tennessee. That program, "This Atomic World," dealt with the nuclear industry and had as its purpose providing factual, objective information about that form of energy. Another program which we sponsored in conjunction with Oak Ridge Associated Universities, "Energy Today and Tomorrow," was a special live education program conducted by a former classroom teacher demonstrating what energy is, how various fuels and methods are used to create energy, what the future holds, as well as the environmental, social and economic problems associated with energy use, including ways to conserve energy. Following the assembly program, classroom teachers received a packet of materials with which to follow up on the concepts presented.

A program which we supported from 1978 until 1983 is an excellent example of cooperation with a nearby university. It was called "Energy

Research for Juniors," and provided an outstanding opportunity for high ability high school juniors to earn college credits while spending six weeks on campus at Iowa State University. A grant from the Iowa Utility Association provided room, board and tuition for the participants and allowed them to learn while investigating an energy problem with Iowa State University scientists and engineers. Dr. Lynn Glass, your moderator today, directed this program. Even if he were not here today, I would tell you that Dr. Glass was the critical element in this program. Matching the students with ongoing research projects which coincided with their interests, checking closely with their mentors to be sure they were having a learning experinece and not just performing busy-work, and coaching the students in everything from survival in the dorm to the use of the library and computer in preparing a research paper, took care of every minute of his time during those years.

The objectives of the Energy Research for Juniors program were to:

1. demonstrate the nature of scientific research by providing first-hand experience in research laboratories under the guidance of research assistants;
2. stimulate superior students by familiarizing them with the daily activities of scientists;
3. supplement usual high school activities with real experience in scientific research;
4. verify or alter supposed interests in scientific careers in research.

It was my pleasure to meet with the students during most of those six week programs and listen to them explain the results of their research to an audience of college faculty members and other students in the group. We know that many of them have gone on to pursue a career in science and it has been most gratifying to us to have received letters from several indicating the part that program had in their development.

Moving on to another example of types of relationships, let me discuss our relationship with a non-profit energy education organization based in Utah—Energy & Man's Environment (EME). In the late 1970s, our members reached a decision that because the funds available for educational programs were limited, we should concentrate our efforts on providing educational opportunities for teachers rather than student programs. By providing opportunities for teachers, we believed that the programs we sponsored would eventually have an impact on more students. Ther personnel at Energy & Man's Environment was made up of former teachers who had perceived a need during the oil embargo to enlarge the educational curriculum dealing with energy. They developed a program in which they conducted in-service workshops for teachers to familiarize them with the issues and the various sources of information which could be used in their classrooms. We provided a grant to that organization to initiate a program of teacher workshops in Iowa. In turn, EME contracted with the Department of Public Instruction to implement the program in Iowa. It was during these discussions that we explored new ground in a public/private partnership, which perhaps is the forerunner of the Iowa alliance that you will be discussing today. By drawing on the Department of Public Instruction staff persons to coordinate the program, all the funds in the grant could go into workshops for teachers and into stipends for those who assisted in the workshops outside of their regular jobs. A state-wide advisory committee was established consisting of representatives of the Department of Public Instruction, the Energy Policy Council, the Iowa Utility Association, area education agencies, state universities, and teachers at the primary and secondary grade levels. This advisory group worked with the coordinator in the direction and implementation of the program, which consisted of in-service workshops held for teachers in all 15 area education agencies throughout the state. As a result of participation in the workshops, a number of teachers throughout the state gave additional emphasis to that portion of their science curriculum dealing with energy. Our support for this program continued from 1980 through 1985. In the final year of this program, federal funds available to the Energy Policy Council for energy education activities had been restricted. So after much exploration, we helped put together an agreement between Energy & Man's Environment, the Department of Public Instruction and the Energy Policy Council which provided for coordination of federal, state and private dollars in a unified program. We believe that it was an excellent educational program for teachers, and the evaluation indicated high marks from those who participated. However, because of certain administrative problems and what we felt were shortcomings which were developing within the organization, we elected to cancel our grant to the EME organization.

This brings us to another example of an effective working relationship, which is with another of our state universities. In the fall of 1985, we reevaluated our role in supporting educational programs. We decided that equally or more important than energy education is that of a total science curriculum. We considered a number of ways in which we might provide support for Iowa teachers, and during our review, we learned of the work which Dr. Robert Yager was doing under a grant from the National Science Foundation. He had developed a "Chautauqua"-type workshop for teachers utilizing the "Science-Technology-Society—S/T/S" concepts. The National Science Teachers Association states: "The goal of S/T/S is to develop scientifically literate individuals who understand how science, technology and society influence one another and are able to use this knowledge in their everyday decision making."

We entered into an agreement for a pilot project in the spring of 1986. Under that grant, we sponsored two sets of workshops during the spring semester and partially sponsored a leadership conference for teachers during the summer. Very positive evaluations were received from the pilot workshops, and we subsequently provided a grant to Dr. Yager for the 1986-87 school year. That grant provides for four additional sets of teacher workshops to be conducted throughout the state, one of which is in process right now at Buena Vista College in Storm Lake. In addition, it provides administrative funds to establish a "Chautauqua office" at the University of Iowa in the Department of Science Education. This office is attempting to maintain a network of Iowa science teachers who have attended the S/T/S workshops in the past. Through the use of a monthly newsletter, teachers are encouraged to exchange ideas which work well, and we might add, those ideas which did not work at all. In addition, certain teachers have been encouraged to submit articles for national educational publications related to classroom activities which they have conducted. Other teachers have been encouraged to take leadership roles in future workshops.

The Chautauqua Program consists of a two-day introductory workshop in which teachers develop an awareness of the S/T/S concepts. During the next two to four months, they work in their own schools in developing and trying S/T/S modules. Then the teachers attend a second two-day workshop in which the results of the S/T/S curriculum development and its use by the students are shared with other teachers and the workshop staff. Time does not permit me to totally review a typical module which might be used in an Iowa classroom, but let me simply say that it attempts to identify a problem, search for those resources which may be used in resolving it, apply a science aproach, focus upon personal impact, and its meaning to the student's career as it might relate to science and technology, discuss citizenshop roles as they would like it to be, with special emphasis on the role of science in it. We are pleased with the progress which is being made in this area, especially the very positive teacher reaction and the willingness to participate in all phases of the program, including the monthly newsletter for the exchange of information.

We are presently reviewing additional facets of this program which may be of benefit, including a conference featuring national speakers involved with science and technology, as well as exemplar teachers from throughout the country sharing their experiences with S/T/S. As a further indication of how the "alliance" can work, we're considering as a part of that conference, inviting other Iowa businesses and industry which use science and technology in their operations to attend a reception for these teachers and possibly even display or exhibit the use of science and technology in their operations. Perhaps the next Governor's Conference on Education will allow us the opportunity to report further developments.

I've discussed a number of examples of working relationships or alliances which we have found to be very workable. A review of this type would not be complete without at least touching on the wide-ranging programs which our individual utility members have had with educational groups within their service areas. These have gone on for years, in many instances almost unnoticed, but have been of great value, we think, in supplying excellent information on energy, business, career possibilities, and curriculum support. We believe they have been very valuable for all concerned and we hope that they will continue, along with the other programs which may be developed in the future.

In summary, any one of the programs which I have discussed could well justify more time than I have with you today. We think each has had its own strengths and has produced its own benefits.

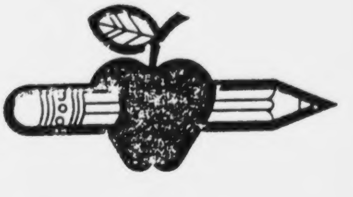
Some Words From =a Friend of STS=

Recently, we received a letter from Irma S. Jarcho of Teachers Clearinghouse for Science and Society Education. She highlighted a few aspects of STS and her experience with it that are well worth sharing with our *Notes'* readers.

". . . I well remember the first time you asked me to appear on an STS program. I was at the NSTA sessions in Detroit. The talk then was, 'Oh, that sounds interesting! I wish I could do it, but my students have to be prepared for their tests.' That was also the time NSF had cut its education budget to zero.

"We have come a long way. There are many states mandating STS courses, our teachers are frantically trying to implement those mandates without too much guidance. At least, that was the impression we received from our audience.

"What I am perturbed about, and wish we could some way guard against, is the idea that STS courses are for the "non-science-oriented student." Mickey Mouse courses, in other words. I feel the future scientist needs STS courses even more than the others do."



Take Note ═Teachers!═

The first-grade class at Devonshire Elementary School in Waterloo recently sent Iowa Congressman Dave Nagle a letter inviting him to visit them and talk about his job. (He accepted, of course; you don't have to ask Nagel twice.)

Along with the invitation, the first-graders sent Nagle letters setting out their own goals.

Our favorite came from Ryan Rand, who wrote: **"I want to change the world, but I'm too busy now going to school learning about plants."**

No Demo? No Lab? No Lesson!

Manhattan Center for Science and Math

by Joseph D. Ciparick

Recently we received an article from Joseph Ciparich, a science teacher at the Manhatten Center for Science and Math. Mr. Ciparich has written to share with us his perceptions of science teaching. He also enclosed samples of materials used in his classroom. We felt Mr. Ciparich's program is working towards an STS orientation, therefore we would like to share his comments with you, our readers.

If I were in charge, this would be the norm for teaching the physical sciences in high school. Lab would *precede* lesson. Any lessons that depended on one dubious demo would be eliminated. Lab reports would be written out in full. Homework would be written summaries of the demonstrations and lessons that accompanied them; and tests, if they occurred at all, would be open notebook. Little or no text material is necessary except for background reference.

Does this sound unrealistic? Is it scientifically sound? We are teaching real science for the first time to young students who have had little experience in the lab. We would like to teach them what science is all about by having them *do* science.

Teaching science does not mean planning so far ahead that you know what you are going to teach six months in advance.

A board filled with notes is not science. Reading about science is not science. Science means observations and questions about observations, and more observations to help answer the questions. Teaching science means being able to elicit the questions through the demonstrations and labs and then designing the subsequent demonstrations and labs to suit the needs of the students.

Teaching science does not mean planning so far ahead that you know what you are going to teach six months in advance. It does not mean following a rigid plan that plunges students into theoretical nonsense in the first month. It does not mean answering questions that students never ask; and it does not mean anticipating their questions by supplying the answers ahead of time.

I am obviously not describing any accepted science program that exists on the so-called "pre-college" level. I am also not describing what is typically taught even in the 8th or 9th grade! I am describing something that I actually did in high school—yes, *daily* demonstrations, truly open-ended labs, lesson plans that depended on what happened in the lab that week, different programs for different classes because different questions were asked.

I sincerely believe I taught a real *science* course. It was nominally a general chemistry course; but, it ended up as a science course, since many of the real problems that came up in the different classes involved not just chemistry, but physics and biology as well. A lot of physics was necessary; for instance, when we came across problems in electrochemistry. So, why not a few weeks of electricity and magnetism?

Labs always introduced the problems. If the problem demanded further lab work for a particular class or for individuals in the class, so much the better. It was often hectic designing the labs that were not really anticipated in September, but the students helped; and that's what science is all about in the long run.

I once had to teach such nonsense; and every once in a while when I am setting up an unexpected lab or trying to devise a demonstration that might answer a vexing question, I longed for the days when I could spend days on end covering the board with game plans for electron distribution, grids with all the values of n, 1, m and s, neat little definitions of conjugate acids and bases, and the variations of $G = H - T\ S$. But I snapped back, realizing that I was teaching science, not game-plans and puzzle-solving and, above all, not math!

But, how are they going to be tested and compared with others? I guess that's what will get the course shot down in the long run.

If we always stuck with "no demo, no lab, no lesson," it's amazing how much real chemistry we could cover. Real problems (such as those discussed in my sequence on solutions) could be studied in depth—in the lab. Theory was not neglected. It helped when it was needed; so too with math. It was a tool, not an end in itself.

Anything wrong with this approach? Is it a dream? In a way, it is. I do teach this way, but the students are the "general chemistry" students, not the elite taking pre-college courses. But, in the long run, they learn more chemistry and may be better prepared for college.

I would sincerely like someone in charge to tell me what is wrong with such an approach, or what is wrong with Henry A. Bent's theories on such a system (Should Atoms be X-Rated?). All we get in the texts are cloned programs that really require no chemistry on the part of the teacher, no challenges, no real experiments that raise real questions. With all the talk of reform, no one proposes the possibility of a real "pre-college" chemistry course such as the one I outlined.

I guess that fact that it might not be the same in every school is one problem. It can't be subjected to "objective" testing. We have to trust the teachers to evaluate the students. We also have to make sure the teachers know enough science to teach such a course. A lot of chemistry teachers know their physical chemistry, but not that many know chemistry. A lot know about fantastic demonstrations that make chemistry "fun," but how many can design their own labs to meet a special need? How many are willing to *read* what students write rather than pass the answer sheets through the Scantron?

Will someone in charge please answer these questions and tell me what's wrong with what I propose?

Survey for Course Content Understanding

Manhatten Center for Science and Math

For each of the following topics, [illegible] the following scale:

(1) It is important, and I think I understand it.
(2) I understand, but the topic is not important.
(3) I do not understand, but the topic is important.
(4) the topic was never treated in any science class, but should have been.
(5) The topic was never treated in any science class, but there was no need for it.

____ 1. Photosynthesis and the food cycle
____ 2. The function and structure of proteins
____ 3. Genetics and inherited characteristics
____ 4. Evolution
____ 5. Atomic structure and bonding
____ 6. Nuclear reactions
____ 7. How a cell (battery) works
____ 8. The electrical nature of the nervous system
____ 9. How the immune system works
____ 10. The role of hormones and enzymes
____ 11. The nature of light and color
____ 12. How a telephone works
____ 13. How electricity is generated and distributed
____ 14. How a radio works
____ 15. How mountains and other geological features came about
____ 16. Stars, planets, and galaxies
____ 17. How a steam engine or automobile engine works
____ 18. Nuclear radiation and how it effects us
____ 19. How cameras, microscopes, and telephones work
____ 20. The relationship between science, technology, and society

List the topics not included that you would like to know more about.

General Chemistry Final Exam Questions

Manhatten Center for Science and Math

Each question should be answered in full sentences and paragraphs. *Descriptions* of all demonstrations and labs that are related must be included.

1. Describe the properties of water, and show how it is essential for life and the basis for many of our chemical reactions. Compare it with other liquids, especially those that are good solvents. Describe some of the properties of salt solutions, especially their electrical properties.
2. Summarize the events that lead to the disaster at Lake Nyos in August 1986. What was the cause of death and how did the gas erupt from the lake?
3. What evidence do we have for thinking that matter is made up of electrical charges? Include all you know about the electrical properties of matter and what you learned from class demonstrations and labs.
4. What evidence do we have for relating elements in groups or families? Describe in detail the experiments on the properties of sodium, potassium, calcium, magnesium, and the halogens: chlorine, bromine and iodine. What did a comparison of their reactions indicate?
5. Describe what you think happens when a salt like sodium chloride dissolves in water. What evidence do you have to back up your description?
6. Describe the similarities and differences between the solvents' water, methanol, ethanol, pentanol, and pentane. How could you account for these similarities and differences.
7. Describe the various forms of carbon. How does it enter into our food chain? What is the "carbon cycle"? What are the differences between the forms of energy carbon compounds release as foods and fuels? Where does this energy ultimately come from?
8. What are some of the theories about the origin of the molecules of living cells? Discuss at some point the relationship between theory and fact in science.
9. What is the most acceptable theory of the origin of petroleum? Describe the various uses of petroleum products. Include specific examples of some of the more common petroleum products that are part of our daily lives.
10. Describe some alternative energy sources, especially those that are "renewable." If some are readily available, why do you think there is so much hesitation in adopting them?
11. Why are energy sources and the use of certain fuels political problems?
12. Discuss the various *different* forms of air pollution and how they effect (a) forests and lakes, (b) the weather, (c) the ozone layer.
13. Describe what radiation is and is not, how it is detected, where it comes from and how it effects the cells of our body. Include the differences between "soft" and "hard" radiation. Give at least one example of the long-term effect of soft radiation.
14. What are the advantages and disadvantages of nuclear power? Explain briefly what a nuclear reaction is and how it differs from a chemical reaction like combustion.
15. What are the lethal effects of an atomic blast? How could one of them result in a "nuclear winter"?
16. Describe in general what natural, radioactive decay is and how it can be a danger as well as a course of our helium supply and the heat deep within the earth.
17. Give specific examples and discuss the differences between "fact" and "theory" or "belief" in science. What are some possible misconceptions of the scientific method?

18. What moral responsibilities must scientists have? Have scientists ever been involved in issues that are immoral or unethical? Give specific examples.
19. What is the relationship between science and invention and technology? Describe some purely scientific discoveries that lead to a new technology such as our modern communications systems. Must scientists always have a practical application in mind when they do research?
20. What are your opinions about the relationship between science and religion? Give specific examples how they seem to differ and how they use the same methods to reach conclusions.

Science Attitude Survey

Manhatten Center for Science and Math

Using the scale below, rate each of the following scientific projects. On the line beneath each project, you may write a short comment.

(1) Should be done, and I would be interested in participating.
(2) Should be done, but I have no personal interest.
(3) Should be done, but only if other projects don't suffer.
(4) Interesting, but of no practical value.
(5) A complete waste of time and money.

____ 1. Exploration of outer space to fine out what the planets and their moons are made of

____ 2. Smashing and colliding atoms to find out the true structure of matter

____ 3. Research on finding alternate energy sources

____ 4. Research that would greatly improve our communications systems

____ 5. Altering the genetic code to create new forms of life

____ 6. Altering the genes of infants to eliminate defects

____ 7. Studying fossils and rocks to see how life might have evolved

____ 8. Research to find new weapons system deterrents

____ 9. Research on the possibility of the existence of UFOs and extra-terrestrial life.

____ 10. Studying ways to protect endangered species

List any research projects not listed that you think would be important, or projects you have heard of that can be evaluated using the scale.

Summer STS Updates

The Iowa Chautauqua Program summer update and leadership weeks are approaching fast. There will be 60 teachers here the week of July 5-11 to participate in the first of our three-year program on "STS Applications of Science."

The following week, the teacher-leaders for the 1987-88 fall short courses will be involved in the Leadership Conference to revise, improve, and prepare for this year's short courses.

The teacher-leaders for 1987-88 are:

Larry Beeson
North High School
Sioux City, Iowa

Susan Blunck
St. Augustin Elementary School
Des Moines, Iowa

James Canfield
Fairfield Jr. High School
Fairfield, Iowa

Vada Flint
Northeast Elementary School
Glenwood, Iowa

Curtis Jeffryes
Cromwell Elementary School
Creston, Iowa

Gary Jensen
Roland-Story Middle School
Roland, Iowa

Larry Kimble
Mt. Ayr Community School
Mt. Ayr, Iowa

Morgan Masters
Chariton Community Schools
Chariton, Iowa

Richard McWilliams
Grandview Park Baptist School
Des Moines, Iowa

Joan McShane
Jefferson Elementary Schools
Davenport, Iowa

Edward Rezabek
Glidden-Ralston Community Schools
Glidden, Iowa

Jeanne Rogis
Oxford Jct. Schools
Oxford Jct., Iowa

Edward Saehler
Lemme Elementary School
Iowa City, Iowa

Ernest Schiller
Central Lee School
Argyle, Iowa

Delwood Students Examine Water Quality

from Maquoketa Sentinel-Press
by Jean Hindman

If you think of water in terms of swimming pools, squirt guns, or watering your garden or lawn, you may want to investigate your drinking water.

Sixth-grade students at Delwood Elementary School in Delmar take clean water seriously since they tested a groundwater sample from a creek a few miles south of Delmar a week ago and found a high contaminant level.

The students are researching water in part of a new take-action science program implemented by fifth- and sixth-grade science teacher Mary Thiel.

"The groundwater project was developed through Science and Technology in Society, a national program offering an innovative approach to science." she said.

"STS uses what is current and exciting in science," Thiel said. "It doesn't matter what these students want to be involved in—farming, business, art, or liberal arts—we learn how to apply things to our life."

Thiel said she became involved in STS through the Chautauqua Project, or traveling show, presented by The University of Iowa Science Education Department. The program was partially funded by the Iowa Utilities Association, she said.

Thiel said the students are currently using Project Wild materials. It is a pilot project for teaching environmental education, she explained.

After the initial groundwater test, Thiel and the 20 sixth-grade students found the contaminate level higher than federal standards allow. With additional research, the students hope to develop solutions to the foul water problem.

The high level of contaminates present in the creek water may be caused by fertilizers and other chemicals sprayed on farm fields which seep into the water supply, the teacher said.

"The concentration may be higher at this time of year because the stream's water was dormant during part of the winter.

"The Environmental Protection Agency considers a maximum of 45 milligrams percent a safe level of impurities in water. The first test showed a contaminant level of 57 milligrams percent. When the first groundwater test was taken in March, many farmers hadn't begun spring plowing and fertilizing, so the chemicals wouldn't be present in the water. Today's test will tell if the water is any worse," she said.

The students amade a second test on Thursday, April 22, to see if the contaminate level had changed. The water sample was sent to the State Hygienic Lab in Iowa City, where the water will be tested and the results returned to Thiel and the sixth-graders.

"The hygienic lab has been very, very good to us; we send a water sample from one of the student's homes every month. The two we sent were safe, but the creek water is unsafe; and hogs, cattle and fowl are drinking in the area," Thiel explained.

These students want to solve the problem in their own backyard.

"We will take one more sample in May, make graphs to show the results, and talk to the County Sanitarian and give the results to him. Our goal is not to blame anyone, but to find solutions to the water problem," she said.

Thiel added that depending on the density of soil and the amount of rock or clay, the contaminates may have taken a long time to seep into the soil.

"In order to understand the complete process of how contaminates enter the ground water, the students built model aquifers to see the relationship between soil type and density and the rate and quantity of seepage," she said.

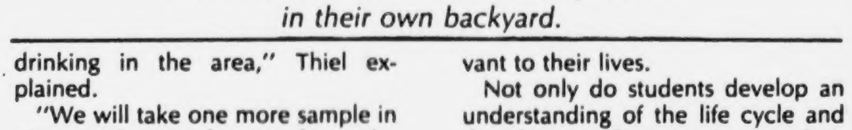
Students used the top half of milk jugs and layered the carton with different types of soil—like sand, top soil, clay, or a rocky mixture of soil By pouring water on the soil, students could see how contaminated water could seep more quickly through sand or fine top soil, and it would take longer through clay or soil.

In addition to the water tests and aquifers, the students visited the Delmar water system; constructed a model of a hydrologic cycle (terrarium); visited the county landfill; heard a presentation by Alvin Wood, a retire Maquoketa well-driller; built a model well; visited the Delmar sewage lagoon system; and visited with state representative Vic Stueland and other state officials in Des Moines about keeping Iowa's water clean for future generations, Thiel said.

She said students enjoy getting involved in Science projects like the groundwater test because it is relevant to their lives.

Not only do students develop an understanding of the life cycle and the danger of contaminating their own water and food supplies, but they concentrate on creating solutions, rather than blaming those who seem responsible, she said. All people are responsible for the environment, Thiel explained.

Thiel said "students could learn about groundwater from a science book, watch some films, and move on to a chapter on weather next week, but then the groundwater problem would see far from home and the responsibility and solutions left to someone else. These students want to solve the problem in their own backyard," she said.



Flight Day

You Mean You Can Learn and Have Fun at the Same Time?

by Morgan Masters
8th Grade Science Teacher
Chariton, Iowa

Over 100 8th-grade students participated in a day of activities with flying and aerodynamics as a center theme called Flight Day.

The day's agenda included the releasing of 140 helium-filled balloons with response tags attached to each as part of a group science and social studies project. Constructing frisbee-type boomerangs, then testing the device for flight aerodynamics in a contest of distance and accuracy. Over three model rockets were launched from Charger Space Center (Reynolds Field) complete with mission control countdown, tracking and altitude measurements and systems checks.

Along with each activity, students had to complete worksheets containing questions covering the topics from all the academic disciplines including math, science, English, social studies, and industrial technology.

The highlight of the day was the touring of the Chariton Municipal Airport with a large number of flying enthusiasts and experts on hand to demonstrate and explain various flying machines and airport facilities.

Some of the personnel who spoke to the students were:

Fred Peterson (Chariton), twin-engine Hy-Vee plane

Edra Parker (Russell), Veri-EZ experimental home-built plane

Merle Fry (Allerton), ultralight plane

David Bailie (Chariton), radio-controlled airplanes

Wayne Whitefield, manager, Chariton Municipal Airport, flight instructor

Mike Whitfield, assistant manager, pilot

Paul Berge (Des Moines), air traffic controller, 1947 "Champ" pilot

Bill Norlin (Indianola), United Airlines mechanic, single engine pilot

Students spelled out HI on the airport runway apron as their science instructor Morgan Masters was invited UP to take some pictures from the air on a 1947 Champ flown by Berge.

A flyby of several planes over the area where the students were having lunch completed a perfect flight day.

The students were assisted is their activities by junior high instructors Doris Barnhart, Rhonda Tekolste, Steve Carman, Harlan Ranshaw, Mike Landstrum, Al Mangels and Masters.

Flight provided the opportunity for students to study scientific concepts by relating them to current societal issues and problems, local resources and expose them to new technologies available.

This approach is a philosophy of instruction called Science/Technology/Society (S/T/S) which utilizes all disciplines and areas of education to create interest and stimulate student learning.

The S/T/S philosophy is currently being used in the 8th-grade science curriculum in Chariton.

It really works; students and adults enjoy learning when the issues are relevant and the resources are as readily available and enthusiastic as those we encountered on Flight Day.

P.S. The pilots and airport personnel enjoyed the day at least as much as the students; they're still talking about it.

Future Workshop and Convention Calendar

July 5-18, 1987
Iowa Chautauqua Project Summer Program
The University of Iowa
Iowa City, Iowa

September 24-26, 1987
NSTA Area Convention
Salt Lake City, UT

October 15-17, 1987
NSTA Area Convention
Miami Beach, FL

November 5-7, 1987
NSTA Area Convention
Pittsburgh, PA

November 14, 1987
Iowa Electric Science Seminar
IE Tower
Cedar Rapids, Iowa

November 19-21, 1987
NSTA Area Convention (anc CAST)
San Antonio, TX

The 1987-88 Iowa Chautauqua Program Dates

October 16-17, 1987
March 4-5, 1988
Holiday Inn South
Des Moines, Iowa

October 23-24, 1987
March 11-12, 1988
Indian Hills Community College
Ottumwa, Iowa

October 30-31, 1987
April 15-16, 1988
Buena Vista College
Storm lake, Iowa

November 13-14, 1987
April 22-23, 1988
Jumer's Castle Lodge
Bettendorf, Iowa

Fall Conference

October 9-10
1987

Best Western Town House
Cedar Rapids, Iowa

Fall Conference Approaches

The First Annual Chautauqua Fall Conference is in the final planning stages. We are looking forward to *your* participation on October 9-10 in Cedar Rapids. Please let us know if you are attending; we need to submit the details to the caterers!

Remember, if you have any questions about the conference, be sure to call us at (319) 335-1190. The schedule for the conference is as follows:

October 9	
4:00-7:00 p.m.	Registration Industry Displays Wine and Cheese
7:00-8:00 p.m.	Dinner
8:00-9:00 p.m.	Speech by Governor Branstad (tentative)
9:00-midnight	Informal Sharing
October 10	
8:00-10:00 a.m.	STS Fair with all former Chautauqua participants involved with a table/booth with up-dated materials/units/activities
10:00-noon	Symposium (short speeches with audience questions) The Honorable Donald Avenson, Speaker, Iowa House of Representatives Dallas Hammerlinck, Vice-President of Marketing and Public Affairs, Iowa Power & Light Dr. Stephen Daescher, Superintendent, Cedar Rapids Community School District
Noon-1:00 p.m.	Lunch
1:00-2:00 p.m.	Speech by William F. Williams, Co-director S-STS Project, Pennsylvania State University
2:00-2:45 p.m.	National Exemplary STS Program a. The Wausau Program - John Harkness, Science Curriculum Director K-12, Wausau Public Schools, Wausau, Wisconsin b. The Jeffco Programs - Harold Pratt, Executive Director, Science and Technology, Jefferson County Public Schools, Golden, Colorado c. Mankind Project - Dr. Arthur E. Lebofsky, Science Department Chairman, Clarkstown South High School, West Nyack, New York d. Wallingford Project - Carol Wilson, Sheehan High School, Wallingford, Connecticut
2:45-3:30 p.m.	Repeat of 2:00 p.m. sessions
3:30-4:45 p.m.	The Future of STS jin Iowa Education/Business/Government Alliance

Awards Recognition

Dr. E. Joseph Piel, Professor Emeritus, Department of Technology and Society, SUNY, Stoney Brook, New York

Dr. Lynn W. Glass, Professor of Secondary Education, Iowa State University, Ames, Iowa

Dr. James G. Macmillan, Executive Director, The Iowa Academy of Science, University of Northern Iowa, Cedar Falls, Iowa

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CHAUTAUQUA
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Volume 3, Number 1
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STS Approaches Enhance Student Attitudes

by Robert Yager

Beginning in 1977 the Assessments in Science by the National Assessment of Educational Progress (NAEP) have included extensive batteries of items in the affective domain. Many of these were administered only to thirteen and seventeen year olds. However, some were used with nine year olds and adult samples as well.

Although the 1977-78 science assessment was reported by NAEP to be the last one planned for science (presumably because science was not considered important), the National Science Foundation supported a Fourth Assessment of Science in 1982 and a Fifth Assessment of Science has been reported by NAEP (now conducted by ETS) in 1987. Hence the third, fourth, and fifth science assessments have all included information about student attitudes. These assessments have been based upon samples of 2,500 persons for each grade level selected from national random samples.

In Iowa several follow-up studies have been conducted with samples arranged by science supervisors and random samples of NSTA members. The results have tended to verify the generally negative findings from the three NAEP reports.

Other studies have been conducted which have included results from students enrolled in NSTA exemplary science programs. These results have invariably illustrated significantly more positive results. Of course, teachers are different, facilities vary, and administrative/community support is often in contrast. Nonetheless, the more positive attitudes are striking, regardless of the specific course(s).

When student attitude has been studied in Grades 4-9 in the Iowa Chautauqua Program, more

(continued on page 3)

TABLE 1

PERCENTAGE OF STUDENTS IDENTIFYING THEIR FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Language Arts	24	4	15	5	16	15
Social Studies	3	2	13	5	13	14
Mathematics	48	24	30	16	18	18
Science	6	24	11	22	12	23

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075)

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060)

TABLE 2

PERCENTAGE OF STUDENTS IDENTIFYING THEIR SECOND FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Language Arts	24	9	18	11	17	11
Social Studies	4	0	14	5	11	20
Mathematics	20	14	19	18	13	20
Science	8	24	18	22	14	17

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075)

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060)

TABLE 3

PERCENTAGE OF STUDENTS IDENTIFYING THEIR LEAST FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Language Arts	22	19	28	22	31	30
Social Studies	3	0	12	38	21	14
Mathematics	18	19	27	22	31	17
Science	11	2	19	6	30	16

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075).

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060).

TABLE 5

PERCENTAGE OF STUDENTS FROM SETTINGS AND FOR THREE AGE GROUPS WHO RESPOND POSITIVELY ABOUT GIVEN DESCRIPTIONS OF THEIR SCIENCE CLASSES

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Science Classes Are Fun	64	92	40	83	25	57
Science Classes Are Interesting	84	82	51	85	46	73
Science Classes Are Exciting	51	78	43	72	40	47
Science Classes Are Boring	10	17	29	13	40	25

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075).

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060).

TABLE 7

PERCENTAGE OF STUDENTS FROM A VARIETY OF SETTINGS AND AGE LEVELS WHO REPORT POSITIVELY ABOUT SELECTED PERCEPTIONS OF THEIR SCIENCE TEACHERS

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Ask Frequent Questions	88	92	75	91	79	85
Likes You To Ask Questions	58	80	55	87	52	75
Likes You To Give Your Ideas	66	70	44	84	40	86
Knows Much Science	69	58	61	88	81	84
Really Likes Science	35	31	78	86	82	87
Admits To Not Knowing	44	68	22	73	14	65
Makes Science Exciting	72	73	51	78	43	58

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075).

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060).

TABLE 4

PERCENTAGE OF STUDENTS ENROLLED IN RANDOM SCHOOLS AND EXEMPLARY CENTERS WITH POSITIVE VIEWS CONCERNING THE USEFULNESS OF THEIR SCIENCE STUDIES

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Useful:						
In Daily Living	72	73	69	60	78	45
For Further Study	83	84	80	76	74	69
In Making Choices	51	64	48	76	49	68
In Future Living	90	90	76	68	71	63

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075).

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060).

TABLE 6

PERCENTAGE OF STUDENTS FROM VARIOUS SETTINGS AND FOR THREE AGE GROUPS CONCERNING DECRIPTORS OF HOW SCIENCE CLASSES MAKE THEM FEEL

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Science Classes Make Me Feel:						
Uncomfortable	6	9	22	10	20	23
Successful	59	63	40	57	30	34
Curious	40	80	24	75	20	63

A - Based on results reported by students of a random sample of National Science Teachers Association members (n = 1075).

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1060).

TABLE 8

PERCENTAGE OF STUDENTS ABLE TO SELECT MOST ACCURATE DEFINITIONS FOR EIGHT BASIC SCIENCE CONCEPTS

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Volume	29	12	75	65	57	71
Organism	66	43	67	71	61	84
Motion	41	14	65	62	66	89
Energy	40	29	54	45	39	64
Molecule	25	29	54	48	53	68
Cell	15	17	46	43	44	42
Enzyme	23	19	24	31	21	52
Fossil	36	29	54	48	48	71

A - Based on results of random sample of students in one midwestern school district (n = 850).

B - Based on results of sample of students enrolled in exemplary science programs (n = 650).

TABLE 9

STUDENTS' PERCEPTIONS OF WHAT IT WOULD BE LIKE BEING A SCIENTIST

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Be Fun	20	60	44	65	16	59
Make You Rich	24	16	38	29	14	24
Be Too Much Work	25	11	26	14	38	16
Be Boring	43	9	29	11	47	15
Make You Feel Important	32	26	55	43	36	40
Be Lonely	24	11	22	12	26	16

A - Based on results of random sample drawn from four large school systems in Iowa and Illinois (n = 890).

B - Based on results of students enrolled in some of the National Science Teachers Association exemplary programs (n = 1140).

TABLE 10

POSITIVE STUDENT RESPONSES REGARDING PERSONAL ACTIONS AND THEIR SCHOOL SCIENCE AND EXPERIENCES

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	A	B	A	B	A	B
Use of Information Outside of School	20	41	18	38	10	31
Assistance With Knowledge of Careers	10	25	12	33	14	41
Fun With Problem-Solving Activities	30	74	23	68	15	55
Parent Interest In School Science Experiences	28	68	15	58	9	39
Technology Affecting Daily Living	18	34	16	56	14	53

A - Based on situation reported by 1,700 students of 100 randomly selected National Science Teachers Association members.

B - Based on situation reported by 1,150 students in ten National Science Teachers Association Exemplary Programs.

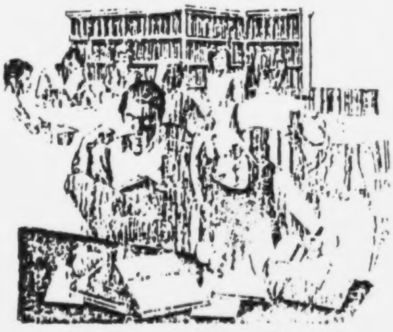
(continued from page 1)

positive attitudes have been recorded. Information is reported in Tables 1-10 which provide baseline information on student attitudes in random schools and those found in the STS exemplary programs. The results utilize 9, 13, and 17 year old samples from the NAEP studies and the national follow-up studies. At a future time Iowa results for additional K-12 grade levels may be reported.

All of the information from the "Preferences and Understandings" instrument have been included in the tables. Tables 1-3 deal with student attitudes concerning their feelings about science classes when compared with other curricular areas. Tables 4-6 report data concerning student perceptions of various characteristics of their science teachers. Table 8 deals with student understanding of eight basic science concepts. Table 9 focuses on student attitude/perception of what being a scientist is like. Table 10 is a report of student attitude concerning the specific utility of their science studies outside the school.

Chautauqua participants are invited to use the Preferences and Understandings instrument each year. It is possible to compare similar classes in a given school, or similar students enrolled in other schools. The data reported in Tables 1-10 can provide a standard for comparing results on each item with those coming from random schools and those coming from students enrolled in exemplary STS programs.

These data may be useful in reports of STS successes for administrators, school boards, teacher workshops, professional meetings, and in-school curriculum discussions. How do student attitudes for students enrolled in STS efforts compare with others? Are students with positive attitudes the ones who pursue more studies, more activities, more science skills? How are preferences, understandings, and out-of-school actions related to the focus for the science curriculum (i.e. STS vs. traditional)?



Why Teach Science in Schools? A New Rationale

by Susan Blunck

Why teach science in schools? Unfortunately, this question does not get analyzed adequately in the minds of most people. For too long, science has been taught without a meaningful rationale.

Science in the curriculum can be justified in many different ways: i.e. the school district provides a textbook (most often used); curriculum guidelines require science (used by administrators and parents often); students need a change of pace before recess and I have to get science in somewhere (used by elementary teachers); students need science information to use in the future (secondary teachers like this one); the course was required (students are partial to this one). Many times rationales for science teaching are based on such simplistic reasoning and result in meaning*less* science for most.

Time has come to shift to a new rationale for teaching science in the schools.

Time has come to shift to a new rationale for teaching science in the schools. Our rapidly changing society demands that the purpose and goals for science education be examined and restructured to meet the needs of the student in the 1980-90s. A rationale with broader aims and purpose is needed. This new rationale hopefully would have as its aim—science that is meaningful for all. The reasons for teaching science should reflect the following ideas as a central part of the rationale:

1) Science should be seen as more than a body of information or facts.
2) Science should develop critical thinking skills needed for decision making.
3) Science should be interfaced with society and technology to make ideas more relevant.
4) Science should be sensitive to student interest, experience, interpretation and understandings.
5) Science should be viewed as a way of preparing scientifically literate citizens, not just scientists.
6) Science should be valued as an essential, integrated part of the curriculum.
7) Science should involve students in meaningful inquiry that leads to applications and connections in their own lives.

In essence, science should be taught so students can come to better understand their own material world and be able to explain and test their ideas.

Science should be seen as more than a body of information or facts.

Given a new rationale, it then becomes necessary to redefine the goals and evaluation instruments for science education. The goals must focus beyond academic preparation. Project Synthesis (Harms and Yager, 1981) suggests that the goals be broken out into the following clusters:

1) *Personal Needs.* Science education should prepare individuals to utilize science for improving their own lives and for coping with an increasing technological world.
2) *Societal Issues.* Science education should produce informed citizens prepared to deal responsibly with science-related societal issues.
3) *Career Education/Awareness.* Science education should give all students an awareness of the nature and scope of a wide variety of science and technology-related careers open to students of varying aptitudes and interests.
4) *Academic Preparation.* Science education should allow students who are likely to pursue science academically as well as professionally to acquire the academic knowledge for their needs.

If science education is to be redefined in terms of its purpose and goals as suggested in this article, then certainly the outcomes for learning will change too. The most important change would be that science has meaning for more students K-12. Performance objectives would shift from knowledge based to other domains, such as process, creativity, applications and connections.

Students would be expected to internalize important information and apply it to their daily lives. No longer would science be bits of information, but rather a dynamic interaction of questions, explanations and verifications that would have meaning for most students.

REFERENCES

Harms, N. & Yager, R.E. *What Research Says to the Science Teacher Volume 3.* National Science Teachers Association Monograph, Washington, DC, 1981.

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Requirements in Asessment

by Robert Yager

The Summer Leadership Conference (and the following work at SEC) has resulted in revisions of several assessment instruments for use by all participants in the 1987-88 program. All participants are asked to provide pre- and post-test scores in the knowledge domain. Possibilities in terms of staff preference in this area include:

1) 1986-87 score on Science Subtest of the Iowa Tests of Basic Skills (or Iowa Test of Intellectual Development); a 1987-88 score which is administrated after the student experience with a significant STS module (at least one month);
2) Pre and post scores on some other standardized science examination, such as Metropolitan or Stanford;
3) A nine week or semester exam given as a pre- and post-test measure with the STS experience between the two administrations;
4) A teacher-made examination on the topics included in a traditional setting and the same one given to students who encounter the same concepts via an STS experience.

Previously, several proven tests have been used on a pilot basis. These have been revised and now exist as:

1) Science/Process Domain Evaluation 4-6 (by Achmad Binadja)
2) Science/Process Domain Evaluation 7-9 (by Achmad Binadja)

Each participant will give one of these tests this year on a pre- and post-test basis. Participants are encouraged to develop similar items to use as forms of evaluation during the STS instruction and as a regular occurrence.

Similarly, creativity measures were optional. This year three creativity measures have been developed. Each teacher is asked to administer one of the following as a pre and post measure:

1) Assessing Aspects of Creativity (by Leonardo Sanchez)
2) Thinking Beyond (by Zoubeida Dagher)
3) Creativity Via One's Imagination (by Joe Lindquist)

If participants prefer to structure more appropriate models on their own, they can do so. Also, teachers are invited to use the tests as model for planning classroom exercises and regular assessment and grading purposes.

As in the past years, all teachers will use the Preferences and Understandings instrument. Norms for these items are included in this newsletter. As in the case of the other instruments, teachers are encouraged to tabulate the results and to discuss the results of the test with the class. Some have found that attention to this domain can result in improvements.

An applications (and connections) test has been constructed over the summer and fall. It has not been used as a test—and in its present form, it is not appropriate for the 4-9 grades. However, it is offered as a model with an invitation for participants to prepare similar items for a test more suited to a particular grade level with examples more related to the specific STS module.

Information for 20-40 students in one or two class groups for each teacher participant will be collected. Information concerning student growth following STS experience will be available. Their domain and the tests for each include:

1) **Knowledge**—Standardized (ITBS) Test Scores/Teacher Module Evaluations
2) **Process**—Science: Process Domain Evaluation
3) **Creativity**—Assessing Aspects of Creativity/Thinking Beyond/Creativity Via One's Imagination
4) **Attitude**—Preferences & Understanding
5) **Applications/Connections**—Applying Science Concepts

Teachers enrolled in past Chautauqua programs may want to see and to use the new assessment instruments. If so, contact Sue Blunck to receive them and accompanying explanations/directions.

Assessing for Applications and Connections

by Robert Yager

Quizzes, unit examinations, textbook/publisher tests, and even standardized examinations labeled as science generally emphasize information that has been studied and discussed. Usually the source of the information is the teacher and the textbook. Such assessment is not a good indicator of science knowledge, skills, or personal attributes that characterize basic/real science. To consider such assessment tools as excusable because they exist, because they are objective, and/or because they represent first-step learning necessary to high level learning is inexcusable. Success in this dimension of science is relatively *unimportant* in terms of real science.

Hence the emphasis necessary with assessing success with STS teaching must be assessing in the application and connection domain. How can a student use information as a tool? How is it connected to the real world? To assume that one can get and already knows information is fine. If a student doesn't know—or can't find out—he/she obviously can't apply or connect it. However, the recitation of information that has no real meaning or use is immaterial—certainly it should not be rewarded as indication of learning in a science class.

We now have several excellent examples of test items in the application/connection domain. However, we need many more. We also need more people to help construct such models that can be shared with others. We know that the samples we now distribute are not appropriate across the grade 4 through 9 spectrum. We know we need help. But that, too, is what STS teaching is all about!

Resources: Teachers, Textbooks, and a Whole Lot More

by Joseph G. Lindquist

"Give someone a fish and they will eat for a day. Teach that someone to fish and they will feed themselves for a lifetime."

I don't exactly remember where I heard this quote (or at least one similar to this) but it's one that has stuck with me. Now what does this quote have to do with the Chautauqua Program or the use of resources in the classroom? Let me see if I can explain.

Even as a student who liked science, and as a teacher who loves it, my experience with the subject has left me with a feeling that something is (or at least, was) missing. When I was a student science was largely something done by *other* people. I was to just learn about all the great things these "other" people discovered, appreciate their accomplishments, and maybe, just maybe, apply some of this science stuff to my real world experiences. Who was I to question the workings of science? Doggone-it, science in the real sense of the word involves questioning and searching for some answers. So why did I feel like an outsider looking into this mysterious world of science? Because questioning and searching was not a major part of my science experience.

So often, I think we as teachers feel our primary responsibility to the students is to supply them with as many facts as possible. Hopefully they will then remember, and maybe even use, the facts we have supplied. Major decision makers involved with our school systems may think this way too—I don't know (although I've got a hunch). But in spite of this, I believe more emphasis has to be placed on helping students learn how to learn for themselves—not feel a teacher and textbook are the primary sources for their science information. Let's face it, after the student leaves school permanently, neither resource is readily available.

> *"Give someone a fish and they will eat for a day. Teach that someone to fish and they will feed themselves for a lifetime."*

To help students learn for themselves, an interest must first be sparked and then encouraged—a big step I know, but certainly not an impossibility for most. They then have to be assisted in getting comfortable working within the discipline of science. Intimidation effects more than just football players; it effects many a student's attitude toward science—stymying their potential in the process.

> *So often, I think we as teachers feel our primary responsibility to the student is to supply them with as many facts as possible.*

Thirdly, students have to continually improve communication skills. Science can be presented in a fashion which allows for two-way interaction. (And yes, I do believe enhancement of communication skills has a place outside of the english classroom!)

Finally, students have to learn how to obtain information from sources outside of the textbook and the teacher. The resources can be a person, place, or a thing. The resource can come from down the school hall or from around the world. Once someone learns how information from a variety of sources can be obtained and used, a skill has been taught and reinforced which could be utilized (and even cherished) for a lifetime.

So this is where my focus for both this article and the opening quote lie. Science teachers need to help students realize other sources of information do exist and then help the students utilize these to answer questions they generate. Who knows, if some of these student initiated questions are answered in an interesting fashion largely through the efforts of the student, then maybe more student initiated questions will follow. Now wouldn't that be great!?

I don't know, maybe I'm too naive to realize students whose inquisitiveness is encouraged while in school don't grow up to continue inquiring as adults. Research evidence may or may not ever surface to help with this possible naive thinking. But I do believe, with or without research evidence, that when teachers don't reinforce student questioning and resource searching skills, far fewer students will magically develop the ability as they grow up to become members of the voting public.

The philosophy behind the Iowa Chautauqua/STS Program may not be the best approach to reinforcing inquisitiveness, encouraging alternative resource utilization, and reducing student anxiety toward science, but it's the best I've come across so far. I feel these three points are important ingredients for helping students learn how to learn for themselves—an important lifelong survival skill. To me, it is like being able to "feed" yourself information for a lifetime.

NOTE: In the last issue of *Chautauqua Notes*, Gary Jensen had a section listing additional classroom resources. I hope to include in every newsletter a list of more of these kind of resources. It's always been a frustration of

(continued on page 7)

(continued from page 6)

mine to realize helpful resources are out there but unknown to me. Please help by sending in some resources you think may be of some help to teachers. I, as a teacher and one responsible for this resource section of the newsletter, would sure appreciate it. THANKS!!!

. . . Rich STS Resources

by Joseph G. Lindquist

1. Invent Iowa!!, c/o Dr. Carol McDanolds Bradley, Iowa Department of Education Ph.# (515) 281-3575
2. New Publications, U.S. Fish & Wildlife Service, Matomic Building Rm. 148, Washington, DC 20240
3. Duane Toomsen, Environmental Education Consultant, Bureau of Instruction & Curriculum, Department of Education, Des Moines, IA 50319, Ph.# (515) 281-3146
4. Agroecology Program, University of California, Santa Cruz, CA 95064
5. *Chem Matters* (Nice activity magazine), American Chemical Society, P.O. Box 57136, West End Station, Washington, DC 20036
6. Golden Guides (Nice bird and insect reference books), P.O. Box 7316, Clinton, IA 52736
7. S-STS Project, The Pennsylvania State University, 128 Willard Building, University Park, PA 16802
8. Tropical Forest Project (Nice information pamphlet), World Resource Institute, 1735 New York Ave. NW, Washington, DC 20006
9. Wonderscience (Nice monthly activity packets), American Chemical Society, P.O. Box 57316, West End Station, Washington, DC 20037
10. County Extension Office (There's a lot more to this than just 4H. They have school enrichment programs!), State 4H Office, Ph.# (515) 294-1017

SCIENCE • TECHNOLOGY
SOCIETY

STS Seminar Presenters Acknowledged Iowa Chautauqua to NSTA

April 7-10, 1988 are the dates for the 36th National Convention of the National Science Teachers Association. Several STS activities of Iowa Chautauqua participants will be featured parts of the curriculum. The NSTA presenters will be:

Joan McShane
—The Fail-Safe Flush
Veda Flint
—Energy - It's Not Shocking
Morgan Masters
—Soaring Through Science: A Study of Flight
Larry Kimble
—Rubber Band Powered Cars

The eight presenters from the STS Seminar in Iowa City on October 10 have been invited to attend NSTA—with the cost of transportation (University van) and a shared room for three nights in St. Louis provided. Sue Blunck is coordinating these arrangements. We all hope that all Chautauqua participants—current and past—will make a special effort to go to St. Louis. Listed below are the presenters and their projects from the STS Seminar:

- Dinosaurs
  Dave Kust, John Kline Elementary School, 204 Fifth Ave., Decorah, IA 52804
- The Fail-Safe Flush
  Joan McShane, Jefferson Elementary School, West 15th Street, Davenport, IA 52805
- "Let the Sun Shine In—Light and Color"
  Veda Flint, Northeast Elementary School,
  309 Ridgeway Drive,
  Glenwood, IA
  51534
- "What's UP? Or: So Where Do You Really Live?"
  Eric Korpanty, Stillwell Jr. High School, 210 Corene Avenue, Waukee, IA 50263
- Energy—It's Not Shocking!
  Shirley Locke,
  Agassiz Elementary School, Route 2,
  Eddyville, IA 52553
- Soaring Through Science: A Study of Flight
  Morgan Masters, Chariton Community Schools, 216 Woodlawn, Chariton, IA 50049
- Lasers . . . A New Light Brightens the Field of Technology, and, Producing an STS Video entitled: "Can You See . . . Science, Technology in Our Society?"
  Dick McWilliams,
  Grandview Park Baptist School, 1701 E. 32nd Ct.,
  Des Moines, IA
  50317
- The Watered-Down Truth
  Ed Rezabek, Glidden-Ralston Comm. Schools,
  102 Utah, Glidden,
  IA 51443

Down The Road Ahead

Future Workshop and Convention Calendar

February 11-16, 1988
National Meeting
AAAS
Boston, MA

January 15-16, 1988
State Meeting
Iowa Conservation Education Council
Guthrie Center, IA

April 7-10, 1988
National Meeting
Thirty-Sixth National NSTA Convention
St. Louis, MO

April 7-10, 1988
National Meeting
National Science Supervisors Association
St. Louis, MO

April 21-23, 1988
State Meeting
Iowa Science Teachers
Ames, IA

April 21-23, 1988
State Meeting
Iowa Academy of Science
Ames, IA

The 1987-88 Spring Chautauqua Schedule

March 4-5, 1988
Holiday Inn South
Des Moines, IA

March 11-12, 1988
Indian Hills Community College
Ottumwa, IA

April 15-16, 1988
Buena Vista College
Storm Lake, IA

April 22-23, 1988
Jumer's Castle Lodge
Bettendorf, IA

Comparing Traditional and Science Teaching

We will be anxious again with the 1987-88 program to identify specific features (teaching strategies) used in teaching science prior to the experience with STS module development and teaching. We will be anxious to compare these pre- and post descriptions for each workshop group. We also plan to compare the results with those received for 1985-86, for summer vs. non-summer participants, for elementary vs. secondary, and any other break-down we can think of. These differences were considered some of the most significant results of our past efforts. Help us expand the list! Be ready to share your observations with others!

Editor's Corner

Hiding in the corner is something I plan on doing this year. This newsletter should be full of teacher-authored articles. The STS projects you are doing in your classrooms are of interest to others in the program. It is important that you make an effort to write down your experiences and mail them on to us.

I know what you are saying to yourself: "I can't write, I've never done it before!" We will help you— just give it a try!!! Your printed articles would be great to share with your students and administrators. Hats off to Pat Mothershead, who has sent us an article for next month's newsletter.

I am looking forward to working with all the teachers in the Chautauqua Program. If you have any questions regarding your STS teaching, feel free to call me. It is an honor to be the coordinator of such a fine program. My office hours are 10:30 to 2:30 p.m. and my number is 319-335-1190. Enjoy the school year and remember connections and applications make the difference in learning.

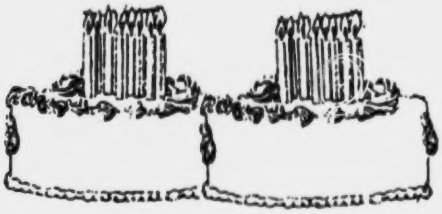
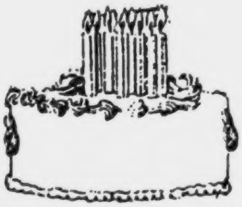
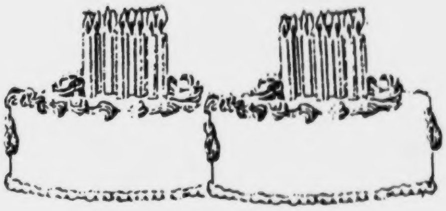
Susan M. Blunck
Chautauqua Program
Coordinator

Birthdays of Scientists

As many noticed, last month's issue of Chautauqua Notes did not list the September and October birthdays. We had no idea so many teachers were using the birthdays in their classrooms. Many of you requested we keep publishing the birthday lists. So, back by popular demand (just like Classic Coke) are the months we missed, along with the November and December lists.

How are you turning these birthdays into STS celebrations? Are you using the dates in a creative way that adds historical perspective? We are interested in finding out how you are using these dates. Send us your ideas and we will print them along with the lists each month.

Sharon Johnston, and her students put these lists together. See what you started, Sharon? Thanks for your efforts.

September

1 Karl Auer 1858
2 John Tyndall 1820
3 Fritz Pregl 1869
4 Stanford Moore
5 Eugen Goldstein 1850
6 John Dalton 1766
7 James Van Allen 1914
8 Marin Mersenne 1588
9 William Bond 1789
10 John Kidd 1775
Carl Mosander 1797
11 Sir James Jeans 1877
12 Guillaume Le Gentil 1725
Richard Gatling 1818
Irene Joliot-Curie 1897
13 Walter Reed 1851
14 Charles Du Fay 1698
15 Murray Gell-Mann 1929
16 Albrecht Kossel 1853
17 Stephen Hales 1677
John Goodricke 1764
18 Jean Foucautt
Edwin McMillan
19 Karl Franz Joseph Correna
20 Sir James Dewar 1842
21 Heike KamerLingh-Onnes 1853
Donald Glaser 1926
22 Thomas Wright 1711
Michael Faraday 1791
23 Johann Encke 1791
24 Georges Claude 1870
25 Olaus Roemer 1644
Thomas Chamberlain 1843
26 Joseph Proust 1745
27 Daniel Kirkwood 1814
28 Ferdinand Moissan 1852
29 Enric Fermi 1901
30 Antoine Balard 1802
Hans Geiger 1882

October

1 Otto Robert Frisch
2 Peter Hjelm 1746
Sir William Ramsey 1852
Julius von Sachs 1832
3 William Crawford Gorgas
4 Michael Pupin 1858
5 Robert Goddard 1882
6 Nevil Maskelyne 1732
7 Niels Bohrs 1885
8 Henri Le Chatelier 1850
Ejnar Hertzspring 1873
9 Emil Fischer 1852
10 Henry Cavendish 1731
11 Don D'Elhuyar 1755
Heinrich Olbers 1758
12 Ascanio Sobrero 1812
Elmer Sperry 1860
13 Robley Williams 1908
14 Sir Edward Sabine 1788
15 Evangelista Torricelli 1608
Asaph Hall 1829
16 Albrecht von Haller 1708
George Westinghouse 1846
17 Edouard Roche 1820
18 Christian Schonbein 1799
19 Jean Delambre 1749
Orville Wright 1871
20 Sir James Chadwich 1891
21 Georg Ernst Stahl 1660
Herman Hellriegel 1831
Alfred Nobel 1833
22 Clinton Davisson 1881
Karl Jansky 1905
23 Nicolas Appert 1752
24 Anton van Leeuwenhoek 1632
25 Heinrich Schwabe 1789
Henry Russell 1877
Richard Byrd 1888
27 Pierre Berthelot 1827
28 Jonas Salk 1914
29 Othniel Marsh 1831
30 Hermann Kopp 1817
31 Sir Joseph Swan 1828

November

1 Balfour Stewart 1828
Alfred Wegener 1880
2 Harlow Shapley 1885
3 Daniel Rutherford 1749
5 Paul Sabatier 1854
Leon Teisserenc DeBort 1855
Fred Whipple 1906
7 Marie Curie 1867
Lise Meitner 1878
8 Edmund Halley 1656
Christiaan Barnard 1922
9 Carl Sagan 1934
10 Andres Del Rio 1764
11 Vesto Slipher 1875
12 John Rayleigh 1842
Seth Nicholson 1891
13 James Maxwel 1831
14 Robert Fulton 1765
Leo Baekeland 1863
15 Sir William Herschel 1738
16 Jean D'Alembert 1717
17 Henry Gellibrand 1597
18 Louis Daguerre 1789
19 Mikhail Lomonosov 1711
20 Otto von Guericke 1602
edwin Hubble 1889
21 Hieronymus Richter 1824
22 Andrew Huxley 1917
23 Prospero Alpini 1553
Jahannes Van Der Waals 1837
Henry Moseley 1887
24 Tsung-Dao Lee 1926
25 Julius Mayer 1814
26 Norbert Wiener 1894
27 Anders Celsius 1701
28 John Hyatt 1837
Sir Robert Hadfield 1858
29 Christian Doppler 1803
30 Ernst Chladni 1756
Smithson Tennant 1761

Call for Papers

100th Session
Iowa Academy of Science
Iowa State University
Ames, IA
April 21-23, 1988

ABSTRACT DEADLINE: JANUARY 15, 1988

You and your colleagues and students are invited to submit an abstract for consideration by one of the 19 sections for inclusion in the Academy's 1988 program. An abstract must be submitted for each paper that will be included in the program.

Forms are available from the IAS office, P. O. Box 868, Cedar Falls, IA 50613 or by calling 319/273-2021.

Abstracts may be accepted by microcomputer communication. Contact the IAS office for details. (319)273/2021

The abstract should be a concise summary of the contents of the paper and not just a general description of what the paper deals with. Be brief but not ambiguous. Do not include tables or graphs, but do include mention of new techniques, new apparatus, new constants, critical data or formulae. Carefully hand-letter symbols not on your typewriter with India ink. Designate all organisms, chemicals, etc., by full scientific names. Names of new species should not be included.

Abstracts will be printed in an 8½ x 11 insert in the March issue of the PROCEEDINGS. Their value is considerable, not only for members in attendance but also for others unable to attend.

IOWA ACADEMY OF SCIENCE
University of Northern Iowa
Cedar Falls, IA 50614-0422

What is Happening Out of Iowa?

by Emil Joseph Piel

New Jersey

1. A Science Technology hands on museum is being developed in New Jersey. This "SCI-TECH CENTER" will be located in Liberty State Park which is just across from the Statue of Liberty. While it will not open until 1991, the staff is now developing an outreach program.

   There is a proposal in to NSF to develop a graduate course "Contemporary Issues in Science and Technology." The course will consist of a series of lectures by outstanding scientists and engineers followed up by curriculum development workshops for secondary school teacher. These teachers will then test these materials in their own classrooms. Graduate credit will be available through NJIT who are the coproposers of the project.

New York

1. New York State has mandated courses in technology for grades seven and eight. The State Education Department has developed curriculum materials and offered teacher education programs in this area. Members of the Department of Technology and Society at SUNY Stony Brook have participated in this program.
2. The museum of Science in New York City has developed a program for introducing teachers and elementary school students to some of the concepts behind the hands-on exhibits at the museum. These materials and activities are used to prepare the students before they come to the museum and for follow-up when they return to their classrooms.

National Program

1. "YOU ME AND TECHNOLOGY" is a series of T.V. programs available for use in the classroom or as PBS broadcasts. A teachers guide is available now, and by the fall of 1988 a student workbook will also be available. A brochure describing the programs is attached.
2. BSCS has an NSF grant to develop a K-6 curriculum in Science-Technology-health. Copies of the proposed curriculum are attached.

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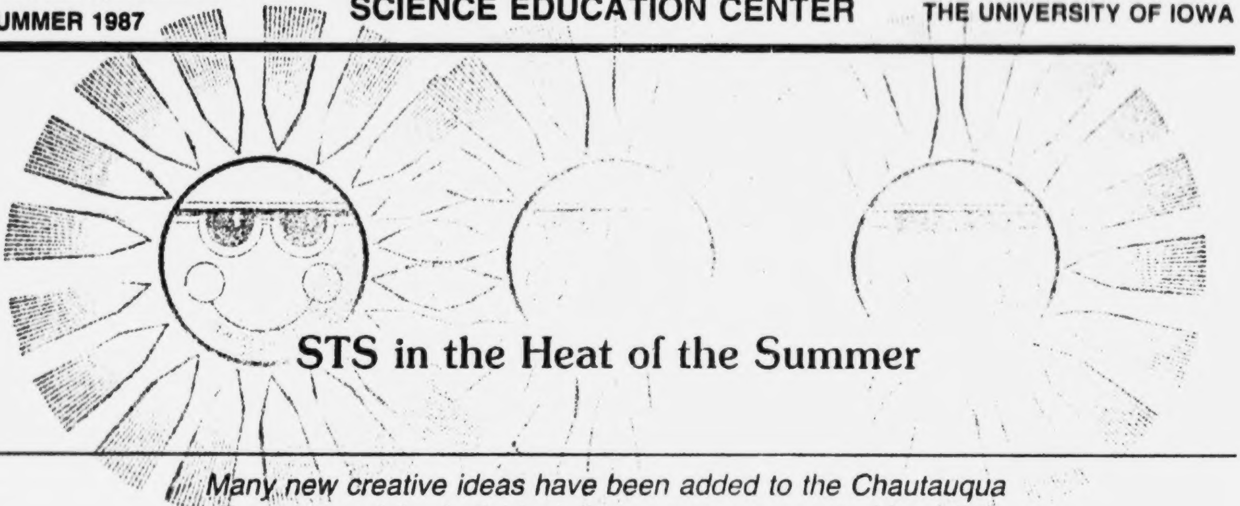

STS in the Heat of the Summer

Many new creative ideas have been added to the Chautauqua Program and the individual classrooms represented here this summer.

The weather sure seems to have had an effect on us this summer. We have, in this issue, more teacher-authored articles than ever before. Perhaps this is due to having a captive group of teachers here in Iowa City for two weeks. Perhaps it was the weather. In any case, I'm sure you'll enjoy reading about the ideas, activities, and agenda items that came from the STS summer workshop. With a total of 75 teachers here the first week for the Applications of Chemistry and Physics STS workshop and 20 teacher leaders here the second week, many new creative ideas have been added to the Chautauqua Program and the individual classrooms represented here this summer.

As we draw the 1986-87 Chautauqua Program to a close and look toward the newly expanded 1987-88 program, we realize that there are many aspects of our growing number of Chautauqua teachers that deserve applause. Many of you in the Chautauqua network have taken the steps necessary to work toward an excellent educational program in the sciences. As you have probably noticed, not only does this STS philosophy help students grasp the component parts of science from a tangible "real world" perspective; it also goes many steps further to integrate learning throughout the curriculum.

There are two aspects of STS programs that become increasingly important as programs develop. These two main components of an STS program encompass the ideas of "integration" and "perspectives." With these two ideas at hand, teachers can help students explore, explain, test, verify, refute, model, and become involved learners.

All too often these two ideas of "integration" and "perspectives" are left out of science classrooms. Science/Technology/Society teaching philosophies, however, put these two toward the front of the objectives list. We are always saying "STS philosophy" instead of "method" or "formula" or "recipe." Does anyone know why? It depends on many factors, but the STS approach to teaching can be considered a philosophy of education, based on how people learn by intrinsic motivation and by being actively involved. This is where the idea of which perspectives we take in class when studying an issue or question is of the utmost importance.

Traditionally, much science has been presented in a single perspective; occasionally an opposing or alternative view is presented, but all too often the perspective taken is one set by a text or a teacher, which in most cases can be a limiting factor

Continued on page 2

Continued from page 1

in learning how to learn in science. But, when STS is introduced into a class setting, perspectives on the subject are only limited by the creativity and curiosity of the students and teachers. The old sayings, "Look at the flipside" and "Walk a mile in my shoes" take on a whole new relevance when we begin to explore questions in the classroom from more than one or two limited perspectives.

Students may be interested in exploring the sociological implications of nuclear power or acid rain in conjunction with the actual science or technology involved with these subjects. When STS is used in the science program, the students are given the opportunity to act on what they think and explore their ideas about the world around them. In theory, no question is out-of-bounds when exploring a topic; this serves to draw the students into the exploration and lead them toward the ideas of integration at all levels of Science/Technology/Society.

The same multiperspective focus can be found in how the students communicate their newfound knowledge and skills to their peers and their teachers. No longer does the static, single domain of knowledge/evaluation carry all the weight. Accomplishments such as class projects, local community actions, and specific expressions of student learning are used to measure success. Along with measures in the knowledge domain of science, these new perspectives on student learning and accomplishments can help teachers evaluate the school science program as well as the progress of the student in the other domains of science. This can help the student become an active learner instead of just a memorizer.

The idea of integration is intimately connected to a multiperspective approach in STS education. No longer does the human-derived boundary of biology, or physics, or other course title, stand in the way of inquiry in the classroom. A successful STS program is one that capitalizes on the many questions from all different perspectives and works toward integrating them into a picture of the subject at hand. A picture full of more questions, connections to many new subjects, and more new perspectives to explore.

STS programs can move toward removing the academic boxes we find ourselves in and in turn put our students in.

In another area of integration, STS programs can move toward removing the academic boxes we find ourselves in and in turn put our students in. Science interfaces with social studies, history, art, and many other areas of study to help the student see the connectedness of all learning; similarities and differences become more easy to define; science fits into many areas of study and they fit into science. I suppose you could consider the ideas of STS education more "wholistic" or more based on informed decision making and inquiry than the old "feed it in, spit it back" method.

This brings me to my last point. I am taking a new perspective on education this fall. I am leaving the Iowa Chautauqua Program and my position at West High in Iowa City to take up residence in the Northwoods of Wisconsin. I will be teaching in Augusta, Wisconsin, at the high school in biology, physical science, and advanced biology.

I am richer for having had the opportunity to meet and work with the many quality teachers here in Iowa and associated with the Chautauqua Program. But it is time to move on and explore new territory. I also think we should all thank the Iowa Utility Association for its excellent continuing support of this effort to create excellence in science education here in Iowa. So, this is my last cover article for the *Chautauqua Notes*, and my last issue as editor. I am sure Dr. Yager, the Chautauqua staff, and the IUA will move the program into the 1987-88 school year with its continued excellence and many new and exciting ideas.

Good luck to all in the upcoming school year, and remember, "Everything is connected to everything else!"

Paul C. Tweed
Editor

Sweating It Out

by Joan McShane
Jefferson Elementary School
Davenport, Iowa

Great groups! Hard work! Hot weather! Stimulating brainstorming! Good discussions! Writing and rewriting! All of these describe the STS Summer Workshop at Iowa City.

The creative group of Nancy Wright, Lincoln Elementary, Dubuque, Iowa; Irene Rockhold, Reynolds Grade School, Reynolds, Illinois, and Bill Ward, Oskaloosa Junior High, Oskaloosa, Iowa, is already preparing exciting STS investigations for their science classrooms.

Nancy plans to have her students discover the effects of weather on people in Dubuque, Iowa. (She promises not to pray for stormy weather.) Irene "saw the light" and is planning for fifth graders in Reynolds, Illinois, to investigate light sources, uses, and effects. Bill Ward is getting down to the "nitty-gritty" and plans to have the eighth graders at Oskaloosa Junior High dig in and explore the need for, and the possible results of, soil conservation in the Oskaloosa area.

Each of them is eagerly anticipating their sharing of these projects at the fall Chautauqua.

I am planning to install a washer in my classroom and hope to do an STS project on the suds level in water and its consequent pollution of water.

A busy fall for all!

Planning and Developing an STS Module

by Larry Kimble
Mount Ayr Community School
Mount Ayr, Iowa

Planning and developing STS modules need not be overwhelming or frustrating.

Developing usable topics can be fun and exciting. Quite by accident, I discovered a simple, straightforward approach that makes topic development interesting and provides a challenge to the students.

First, decide upon a topic. Write it at the top of your paper or chalkboard. Divide your working areas into groups under the headings of Science-Technology-Society. In the first column list the science concepts. In the second column list the technological applications. The third column should list the societal issues arising from the applied technology. Extending beyond the three main issues, students could examine resources, careers, and other related activities.

The extensions can be brought into focus by making more columns or, first, by making lists using the same brainstorming techniques, or using other reference materials. These activities will awaken the inquisitive minds of your students. Reaching this point allows you plenty of latitude in developing issues, goals, objectives, and procedures pertinent to your modules.

If you cannot identify with an approach via this method, you may find it easier to modify an existing traditional unit by listing relevant topics under the headings of Science-Technology-Society. This may be the vehicle to propel you into infusing STS into your existing curriculum. Goals, objectives, and procedures may be developed to accompany any topic. With either method you can find success. The module may be modified or expanded at the teacher's discretion to fit future needs.

Too Much vs. A Must: A Chautauqua Rookie's Perspective

by Joseph G. Lindquist
Emmons Public School
Emmons, Minnesota

UI Chautauqua Program

What happens when you bring a rookie into contact with a group of veterans? What happens when you take a classroom teacher and present him/her with a new approach to teaching science? To name just a few reactions, there is nervousness, confusion, and, oftentimes, learning. So it was with this young teacher at the Chautauqua Summer Session—1987.

I flew in on the "back of a swan"* and over the period of one week came in contact with better than 70 Iowa teachers. The experience level of these teachers varied from a couple of years to a couple of tens of years. This group was composed of a large percentage of people new to the STS/Chautauqua program with a nice nucleus of field-tested veterans. For me, a five-year science teacher, the environment was super for introduction of new ideas, reinforcement of old ideas, and application of both new and old concepts. Granted, it was overwhelming, but so it is in a world of growing knowledge.

Feeling overwhelmed is natural for teachers. From my perspective as one who survived the initial blast of new philosophy and ideas, I would like to encourage others to fend off concerns over exposure to yet another new teaching strategy and at least allow yourself and, hopefully, your colleagues time to try, revise, and then grow with the STS philosophy, thereby putting relevancy and the practice of scientific thinking back into the hands of the students.

Like the rookie meeting the veteran, STS may seem intimidating and just another part of a subject many are "allergic" to. Yet as I see it, STS relieves some of the pressure of teaching science, simply because of the students' use of inquiry, discovery, and the utilization of resources outside of the classroom; it takes the label of "resident expert" off the teacher and replaces it with "facilitator/possible resource person." I am already sold on how the science phobia of many teachers and students is being reduced with the STS method of teaching science.

There is a real need for more K-12 teachers to be exposed to the STS philosophy. With its push to make science real and applicable, STS is promoting communication and cooperation between industry, the general public, and school districts. So please, all of you Chautauqua people, spread the word about STS. I know one rookie who will.

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*Editor's note: We are still trying to locate this swan as we have yet to see Joe ride it.

Lead Teacher Comments

Many educators feel they do not have anything of great value to share with each other or it makes them feel uncomfortable to speak or write of their individual accomplishments. Communicating successful teaching strategies, introductory and follow-up activities, and resources is again an example of an ideal founded with the original Chautauqua philosophy. Share your enthusiasm, it's contagious!

Fun, exciting, relevant science being taught and enjoyed in our classrooms. Oh!!! What a disgusting thought!

Keep up the good work. You are turning a lot of young people on to science rather than turning them off. Hope you have a super year.

Teacher Leaders:
Morgan Masters
Chariton Community Schools
Chariton, Iowa
Larry Beeson, North High School
Sioux City, Iowa

Communicating successful teaching strategies, introductory and follow-up activities, and resources is again an example of an ideal founded with the original Chautauqua philosophy.

Environmental Experience 1:
You Gotta Wanna Make a Difference!

by Ed Rezabek
Glidden-Ralston Community Schools
Glidden, Iowa

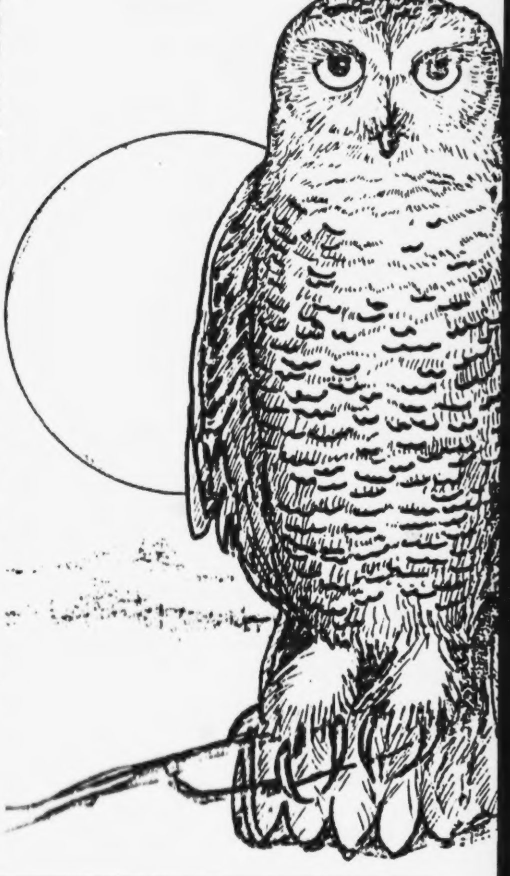
When you reach the age of 40 you either get braver or crazier! Take 30 eighth graders on a two-day, overnight tent camping trip? Take 30 eighth graders, who have been dubbed "The Darlings of G-R" back in fourth grade because of the shenanigans they have pulled off, on a two-day, overnight camping trip, yet! They said, "You're crazy!" We (the class and I) said, "You're wrong—and we'll prove it!" . . . WE DID!

I have been wanting to provide my earth science class with such an opportunity for several years. We have an excellent state park at Guthrie Center that has excellent facilities for such an experience—dormitories, food service, environmental education experiences, the whole schmear. The only problem I have with this is that I deal with the here and now and have trouble making plans for two years in advance, about the time you need to reserve ahead to schedule a stay at Springbrook.

So, what are the alternatives? Forget it; keep thinking about going; set it up two years from now; or—take a chance—set up your own trip to a different place. I've been reasonably cautious in my life. I wear my seatbelt most of the time. I look both ways before crossing the street, and so forth. So, when I look back on why I have decided to undertake this activity the only rationale that I have is that you do get braver/crazier after you are "over the hill."

I considered other places in our area for the camping trip, keeping in mind teaching resources available to me. We have a small state park called Swan Lake a mere seven miles away. Most of the kids had been there many times. But this time could be different. I contacted Joe Halbur, the park naturalist, as to possibilities. He said, "It's never been done by a school group before, but let's give it a try."

I visited with Joe during the next several days and we discussed what activities he could conduct and the activities that I would like to see included. We came up with quite a list. From this list I decided to let the students tell me what activities and studies they were interested in. So, I took the list back to the classroom and asked them to pick out and rank ten activities from my list. We went with the students' choices and set up the trip. There was some discussion with my principal as to this project and we proceeded. By the way, he was all for it.



Overview of trip

The project began with a classroom session on camping. This activity was conducted by the naturalist and dealt with types of camping, needs for camping, and other preparations. During the next few days we worked on developing our own list of needs, tents, cooking materials, and supplies. (Money was suggested as an alternative here—so we could run in to McDonald's if the cooking didn't work out!)

On Monday, May 18, we loaded up the school bus, after which I slipped back inside the school for one last cup of coffee and a bottle of aspirin—just in case.

Swan Lake is only about seven miles from Glidden so needless to say there was no time for the enthusiasm of the kids to die down. We didn't have to make any "potty" stops, and no one asked, "Are we there yet?" Things were looking good!

> *We loaded up the school bus, after which I slipped back inside the school for one last cup of coffee and a bottle of aspirin—just in case.*

The schedule

Arrival and camp setup, plus a little free time for "exploration" = 1½ hours.

Orienteering and Survival: What is orienteering? Using a compass and completing the course. Survival considerations when lost. = 2 hours. (Of course, during the previous six weeks we had had little or no precipitation. Guess what? It rained during the first activity! Things didn't look that good but the weather gods smiled on us; the rain stopped about an hour later and it got nice and hot.)

Boating, Canoe Instruction, and Water Safety for half the group and Food Gathering Techniques utilizing modern technology—the fishing pole and man-made fish attractors—for the other half. = 2 hours.

To handle the cooking and cleanup we had established beforehand, by a random drawing, teams of four people. Each group drew for their assigned task and carried it out as a team.

Indoor Astronomy: Activities to identify and locate the circumpolar constellations, student invention of constellations, and star staff. = 1 + hour.

Outdoor Astronomy: Using charts to identify and locate the circumpolar constellations, student invention of constellations, and star stuff. = 1 hour.

I had decided beforehand to use a pre-/posttest on attitudes and understandings related to this trip. The results of this attitude/understanding survey proved very positive.

Camp Fire: Smores, pies, and more.

Owls and Owl Calling: Around the camp fire with complete silence—this was astounding in itself—we called owls and got some answers! = 1 hour

Lights out! Most then settled down and some even got some sleep.

Some of the early risers were up by sunrise and out fishing. I brought my pole and joined them! The breakfast crew took care of business and we were ready for day 2.

Fish of Iowa and Swan Lake Restoration Project: Iowa has a variety of fish in its streams, ponds, and lakes. The renovation of Swan Lake was a three-year process; what happened during the restoration, and why? = 1 hour

Wild Edibles—There are many species of plants and other foods that can be eaten from the outdoors. Many have eaten mulberries from the tree and bass from the lake, but how many have eaten cattail, french fried dandelions, or munched crayfish? This fit in nicely with recalling some survival techniques from the previous day. = 1 hour

Archaeology: Much of our past is learned through digging into the land. Simulated dig methods the archaeologist uses. = 2 hours

Rabies and Wildlife: What rabies is, how it is spread, and what you can do to protect yourself and others.

Outdoor Games: A variety of games based on environmental information.

Break Camp: This phase was not as neat and orderly as the loading phase! After sorting out the unclaimed shoes, skivvies, and other miscellaneous items, we were headed for home.

One more stop.

Cemetery Study: A look at material and styles of tombstones—tried to understand short life spans noted on some stones, and in general get a little understanding of our past. Also did stone rubbings.

WE DID IT! We all survived and only had to get the first aid kit out one time for a Band-aid.

Evaluating the activity: I had decided beforehand to use a pre-/posttest on attitudes and understandings related to this trip. The results of this attitude/understanding survey proved very positive. When looking back at the trip, I only had to remember one happening to realize that this experience was worthwhile. As I was sitting at the fire (keeping an eye on the fire, and on the attempts to roam from tent to tent), two girls came up to me and said they wanted to thank me for taking the class on the trip. "Our families have never done anything like this, and we think it's neat!" they said. That was enough of an evaluation to make it worthwhile for me.

The "Darlings of G-R" had done it. They had improved their reputation.

Will I do it again? You bet—when a bunch of seventh graders run up to you and ask if they get a chance to go camping next year, what can you say?

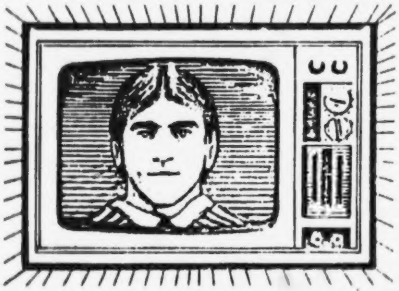
Take a chance. Make a difference.

Eight Benefits of Using Video in STS Teaching

by Dick McWilliams
Grandview Park Baptist School
Des Moines, Iowa

An STS video tape library can be started at your school, local AEA, and college.

Video is one of the most prominent forms of media, if not the most prominent, in the world today. Movie videos, music videos, and home VCR use are extremely popular. So why not use video as a tool in effective science teaching? STS teaching lends itself to the use of video in the classroom. Why not develop video projects?



Why not use video as a tool in effective science teaching? STS teaching lends itself to the use of video in the classroom.

The benefits resulting from video use are as unlimited as your imagination. Here are eight.

1. Students become familar with using video, audio, and computer equipment.
2. Students learn how to perform properly in front of a camera. All classroom activities can be videotaped, including oral reports and audio narration.
3. Students learn to organize data and edit it into a final STS video. Repetition of knowledge is viewed and heard as students edit tapes over and over. Students are subtly learning by repetition.
4. Parents and relatives love to see what students are doing in the classroom. This is great public relations.
   Parents may purchase copies of the video project for home use to show grandpa and grandma, friends, and so forth.
5. Students naturally take pride in this type of class project.
6. Students work in committees (video, audio, narration, script, resources, editing, etc.), which teaches them the team concept.
7. An STS video tape library can be started at your school, local AEA, and college (for student teaching courses).
8. Students may interview professionals and celebrities on local, state, or national levels, using video equipment. What better way to preserve the views, opinions, and information of those taped?

The Modem: Opening Classroom Doors

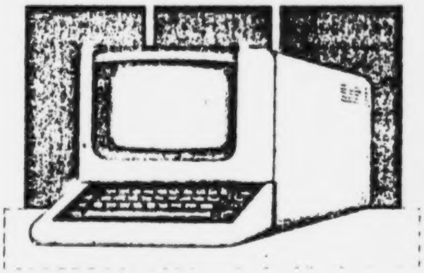
by Dale Rosene
Marshall Middle School
Marshall, Minnesota

The computer modem has opened wide a door connecting the classrooms of a community, a state, and indeed the entire nation and beyond. Educators and their students are able to cooperatively produce a newspaper, share the results of student research, and even ask questions of experts, while seated at computers hundreds and even thousands of miles apart. Though found in only a few classroom computers at this time, modems are the wave of the future as teachers and students realize their potential, ease of use, and relatively small purchase cost.

The modem is a device that allows computers to communicate with one another. Some models are installed within the body of the computer, while others are connected to the outside of it by cable. The modem, in turn, is linked to telephone lines, allowing long-distance interaction.

Modems range in price from about $50 to several hundred. All need communication software to operate. This, too, can range in price from free, in the case of public domain programs, to fancy packages costing several hundred dollars. Other users and/or the staff of a good computer store should be able to suggest appropriate software for the uses you have in mind.

The best way to become acquainted with the modem's potential is practicing with local "bulletin boards." A "bulletin board" is a computer program set up to accept and send messages from one user to another. These are often maintained by local computer clubs as a means of providing information about club and area activities and as a forum for enthusiasts to use in exchanging ideas and information. Local phone numbers for connection to these bulletin boards can usually be obtained from other users or from computer stores. Later, the new user might consider purchasing time on one of the national boards, like Compuserve, that offer a wide variety of services, such as research help and stock prices.



The use of a modem gives S/T/S teachers yet another tool to open their classrooms to the "real world."

The use of a modem gives S/T/S teachers yet another tool to open their classrooms to the "real world." Not only will students be able to use the same technology that they see in banks, travel agencies, and other places, they will apply it to problems and projects of their own choosing. Already, teachers in New Mexico are connected in a statewide network called CISCO. Former Iowan Paul Tweeten heads this project. Local directors are considering a similar setup for Iowa S/T/S participants.

Teachers interested in some cooperative modem activities during this school year are invited to contact me with their ideas. I teach eighth grade physical science in a middle school. Get a modem and give it a try. I guarantee you'll be glad that you did.

Student Misconceptions and STS

by Cheryl Donlon
St. Benedict School
Decorah, Iowa

In a traditional classroom with teacher-centered presentation of material, there is little opportunity for the teacher to assess or even care about the misconceptions students bring into the classroom. Evaluations are based on restatement of facts learned from teacher or text. Teachers place heavy emphasis on the body of science knowledge as the means and ends of science learning. Students leave the classrooms with their alternate conceptions intact, rarely questioning why they believe as they do. They aren't particularly bothered when their ideas conflict.

In the STS classroom students are encouraged to share their ideas about issues and engage in dialogues. Debates, roleplaying, and simulations are very effective techniques; students have the opportunity to explore their emotions and their values, sharpen their communication and research skills. They refuse to accept the word *because* as an answer to "why."

By fostering this student-centered environment in the classroom, students make choices and take stands—sometimes very vocally! In this learning environment, alternate conceptions become more easily defined—*by the students.* They may alter or abandon their misconceptions as they develop their problem-solving and decision-making skills.

STS allows students to practice decision-making strategies that can lead to action on real-life problems. Are you willing to provide this learning environment for your students?

Math Is Science! Science Is Math!

Use of Science/Technology/Society ideas helps bridge the gap between the analysis of data and how this data affects society.

by Ernest Schiller
Central Lee High School
Argyle, Iowa

Many science activities incorporate the use of skills typically viewed as being contained in separate academic disciplines. Science students are using mathematics to help explain science phenomena. You can't separate the use of mathematical concepts from the use of data collection methods in the classroom. I am sure that this has occurred in your classroom as well. Many of your students may have problems analyzing the data in science material, but it may not be the science that is causing the difficulty. Math concepts play an integral role in assessing information in science. A lot of decision making is involved in science. The principal investigator will most probably have to use estimation, categorizing, sorting techniques, graphing, and placing mathematical values on data collected.

The addition of STS to the science classroom can assist in helping solve this problem with science. Use of Science/Technology/Society ideas helps bridge the gap between the analysis of data and how this data affects society. Students begin to see connections between generated numbers from investigations and the importance of analysis and understanding the interactions studied. They begin to assume the role of the person who makes the decisions. Students can begin to set the tone for the human interaction factor. They are the ones who determine personal needs, societal implications, and community needs. With the STS approach, they are the ones who can make discoveries, such as that the Earth's resources are finite. STS encourages the students and the teachers to investigate questions in science from many perspectives using a variety of tools and methods. It makes science more enjoyable and related to the student's future and puts science concepts into proper perspective as they relate to the students' lives. STS bridges science and society. And it creates a basis for understanding the relationship between the disciplines of science, math, and other academic pursuits. Students will appreciate the connection.

A Letter to the Summer Participants

Dear Fellow Chautauquans,

Why all the bother about this thing called STS? You can't eat it, measure it, pronounce it, and few if any can really define it. The answer is simple—the students.

Like many other past participants, I hurried home after my first Chautauqua to expound all the virtues of this thing called STS to my less-than-enthusiastic principal and fellow staff members. Their general apathy, mild disdain, and choruses of "just another fad" left me a bit crestfallen and dejected.

Undaunted, I decided to give it the acid test. If this thing STS was worth its salt, then it would have to sink or swim with the students.

The rest of the story, as the saying goes, is history. With kids walking into the room excitedly anticipating class, parents complaining that all they heard was what went on in science today, and fellow teachers peeking in the door to see what you're up to, it was clear that STS works.

When you give your unit its first acid test, then you, too, will know it was worth all the hard work!

Yours in science,
Curt Jeffryes
1987 STS Survivor

. . . Rich STS Resources

Expand your collection of classroom resources.

by Gary Jensen
Roland-Story Middle School
Roland, Iowa

This selection of materials was compiled by Summer STS participant Greg Hawk.

Living Lightly on the Planet. Maura O'Connor. National Audubon Society, 1111 East Brown Deer Rd., Milwaukee, Wisconsin 53217

Science Scope. NSTA. 1742 Connecticut Ave., N.W., Washington, D.C. 20009

Magic and the Educated Rabbit. Joel Goodman. Instructo/McGraw-Hill, Paoli, Pennsylvania 19301 (1981)

Blueprint for a Green Planet: Your Practical Guide to Restoring the World's Environment. John Seymour. Prentice-Hall.

Waste to Wealth [and many more titles]. Neil Seldman. Institute for Local Self-Reliance. 2425 18th St., N.W., Washington, D.C. 20009

How to Hold a Crocodile. Diogrow Group. Treasure Press, London, England (1986)

Paths to Nature. Davenport Community Schools. 1100 Harrison St., Davenport, Iowa 52803

Big Secrets. William Poundstone. Quill Publications, New York, New York (1983)

Bubble-ology. Jacqueline Barber. GEMS. Laurence Hall of Science, University of California, Berkeley, California

Bubbles. Walt Bogan. AAAS. 1333 H St., N.W., Washington, D.C. 20005

Science Works. Ontario Science Centre. Addison-Wesley Publications Co., Inc., Reading, Massachusetts (1984)

Game. Ecology-oriented word puzzles.

Physical Science Activities (Life Science and Earth). M. Tolman. Area 13 Educational Services.

ABC'S of STS

by Dick McWilliams
Grandview Park Baptist School
Des Moines, Iowa

Introduction

As a science teacher, you don't have to be hit on the head to know the students are losing their interest in science. Needless to say, science education is a little rocky.

These ideas will hopefully show the benefits of an STS approach to teaching. Try to derive concrete ideas and set them in stone as you read through this STS alphabet.

Aa—Aroma

Let the atmosphere of your classroom tantalize the taste buds of science in your students.

Bb—Bird Brain

We don't want to turn out students with bird brains who simply parrot back knowledge.

Cc—Cop Out

We don't want students who cop out on science. Let's motivate them to remain enthusiastic about science.

Dd—Discover

Allow students to discover the world through STS teaching.

Ee—Enthusiastic Eyes Wide Open

Students should leave school enthusiastic about science, having their eyes opened to societal issues.

Ff—Future

Prepare students who are equipped to tolerate or cope with future society.

Gg—Gang Buster

Join the gang of STS teachers in Iowa. Have a ball and break the chain that imprisons you to the old traditional science teaching.

Hh—Head Knowledge

Head knowledge is not enough. Practical science is the ability to make applications in a society abounding with questions in decision making.

Ii—Investigation

Allow students the privilege of bringing items of interest to them into the classroom.

Jj—Jet Propulsion

Some students need a little jet propulsion to get them into the realm of science. Start them in the right direction; try STS.

Kk—Knowledge

Science teaching should include more than just textbook knowledge.

Ll—Love

STS helps students to fall in love with science.

Mm—Magic

STS is magic. Sometimes it's a matter of deciding which crafty activity to use.

Nn—Numbskull

In an STS classroom no student feels like a numbskull. All are actively participating.

Oo—Oasis

Are you looking for that oasis in teaching? Try STS. It'll satisfy your thirst for a new teaching method.

Pp—Point Out

When teaching by STS methods, we are also pointing out societal issues, and students hopefully will be pointing out possible solutions to issues.

Qq—Questioning

STS teaching encourages and allows for students to question, which in turn allows for creativity.

Rr—Rake in Resources

STS encourages raking in resources (parents, businesses, etc.).

Ss—Serious Thinker

We hope to stimulate our students to be serious thinkers who will not laugh away their responsibilities in society.

Tt—Tell Everybody

Let's tell everybody we can about STS teaching.

Uu—Undercover

We don't want to keep the fun of science undercover. Bring the fun of science back into the classroom. Use STS.

Vv—Vocations

Vocations in science are more readily envisioned by students who have been introduced to these vocations by STS learning.

Ww—Wondering

We don't want students who graduate wondering how they graduated, but rather ones filled with the wonder of science.

Xx—X-amination

X-amine your teaching under the STS mircoscope.

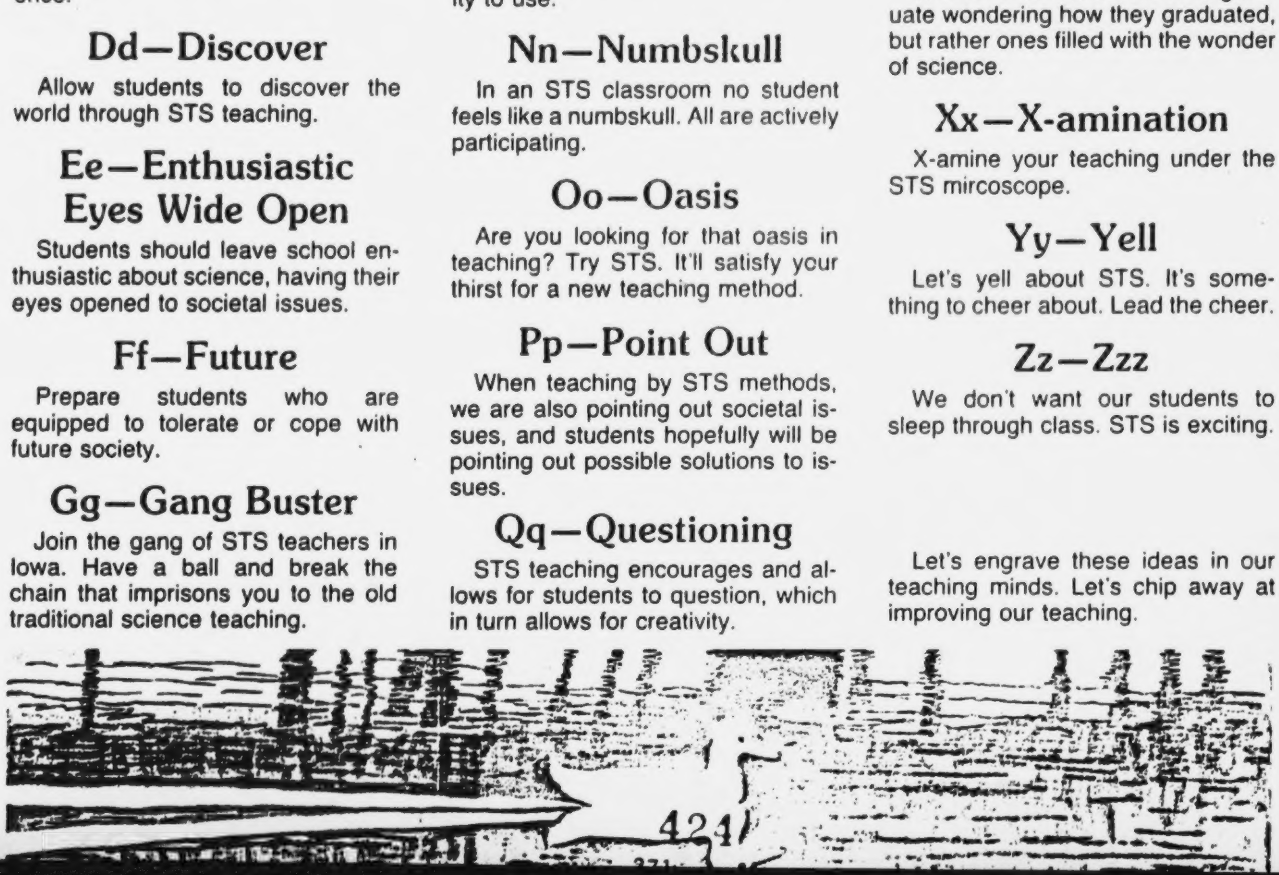
Yy—Yell

Let's yell about STS. It's something to cheer about. Lead the cheer.

Zz—Zzz

We don't want our students to sleep through class. STS is exciting.

Let's engrave these ideas in our teaching minds. Let's chip away at improving our teaching.



One Approach to Energy Education

by Willard H. Asmus
Hoover Intermediate School
Waterloo, Iowa

The gasoline and natural gas shortages and the constantly rising fuel costs of the middle 1970s and early 1980s provided substantial evidence of a need for students to be educated in the areas of energy and energy conservation. It is apparent that though we are the largest energy-consuming nation in the world we have neither the education nor the skills to cope with an energy crisis.

As a science teacher, I feel it is imperative that an energy program be designed that is both applicable to and appropriate for the sixth grade student. Such a program should provide information on the tools available and the need to minimize energy costs and energy consumption.

Two goals were established to be met by this program.

1. to understand the economic mechanism underlying events and situations affecting students indirectly;
2. to understand how to apply economic ideas to minimize personal energy costs. This should help students become energy-conscious consumers.

The sixth grade science curriculum I developed is a hands-on approach to science education that provides concrete, firsthand experiences. The kitchen science philosophy is used to implement the program, because this facilitates science as a positive everyday experience and not an experience isolated in the laboratory.

Units were developed to promote interest in energy science, in an intensive eight-week science study unit. The energy unit is presented to approximately 100 sixth grade students.

The classroom is conventional, with a population of 24 to 27 students. Each classroom receives a complete energy kit with materials needed to perform the activities. Specific materials are placed in tubs. The materials coordinate with individual lesson plans and are grouped in levels corresponding to specific classroom activities. Transparencies of sample activities and activity sheets for students are included. Supplemental materials (transparencies, kits, and energy-related equipment) are available for checkout from the district's resource center.

Our district science program strives to develop in each student

1. a positive attitude toward science as related to himself/herself;
2. curiosity, initiative, creativity, and objectivity;
3. understanding and respect for the environment;
4. fundamental skills in manipulating laboratory materials and equipment and gathering, organizing, and communicating scientific information;
5. an attitude that reinforces study and academic skills taught in other areas of the curriculum;
6. rational thinking processes that underlie the scientific approach to problem solving;
7. an awareness of the relationships among science, technology, and the society in which the students lives.

The program encompasses work in Energy and Energy Alternatives, which is part of the district's required middle school science curriculum.

Activities are planned for students to use process science: observing, classifying, measuring, collecting and organizing data and ultimately predicting and inferring the outcomes of specified events. All students become actively involved in the investigations, either in small groups or individually. They record pertinent data, then make generalizations and draw conclusions. The program is not only science; it incorporates mathematics, language arts, social science, and fine arts skills.

The first unit of the energy program emphasizes the nature and importance of energy and energy sources in our lives. The second unit examines how and why energy works. The concluding unit examines the impact of energy in our lives and the role of alternative energy sources.

There are additional resouce materials and equipment to augment the energy unit. The district and area educational agency film library has energy-related films, filmstrips, and kits to be used in conjunction with the energy units. Iowa Public Service, the local utility company, provides materials and in-class energy education programs. (Contact the utility in your area to find out about similar programs.) The background provided by the unit experience, namely, the activities, lessons, films, books, and speakers enables the students to experience discovery, small-group decision making, and the process of drawing conclusions based upon research.

Student and program evaluations focus on the development of higher order cognitive skills. Four goal clusters, identified by Project Synthesis, an activity funded by the National Science Foundation, describe desired results of a science education program. The four goal clusters are personal needs, social issues, academic achievement, and career awareness. The diversity of affective and cognitive student outcomes makes a variety of evaluation procedures and techniques necessary. Cognitive behaviors can be measured adequately by traditional means, but certain affective measures require observation schemes and student-kept records for in-class and out-of-class activities. Whatever the evaluation techniques, they should be designed to measure the diversity of the intended student outcomes.

Through experiences, activities, and exposure, the students gain self-confidence, added experience with the scientific process, and improvement in basic skills through creative approaches to reading, writing, reasoning, quantitative thinking, and an awareness to a variety of science- and technology-related careers open to their interest.

Through this program, students become aware that the energy program is a human-made problem and that there are alternatives to our present predicament. Children can be helped to see that in a world rich with alternatives, people, as individuals or in groups, must choose their solutions carefully.

Student and program evaluations focus on the development of higher order cognitive skills.

Chemistry—It's Elementary!

by Veda Flint
Northeast Elementary School
Glenwood, Iowa

The previously foreign words, *bases, acids, indicators, solutions,* and *titrations,* became part of a second language in the vocabulary of Beth Bloom, Annette Norris, Nancy Edwards, Dorothy Hall, and Judy Havnen as these five elementary teachers from the Des Moines Area Schools took part in the chemistry section of the summer STS Workshops in Iowa City.

Participating in Dr. Deskin's chemistry lab each afternoon gave them hands-on experience and insight into how chemistry can be applied at the elementary level.

Already in step with STS, Beth Bloom is preparing to teach a unit on air pollution. Annette Norris is deep into oceans and Judy Havnen is developing a unit on mammals. Dorothy Hall and Nancy Edwards worked cooperatively on soil conservation, realizing Iowa is rapidly losing ground.

Thank You

We would like to take this opportunity to thank all of you for your hard work and help in making the 1987 Summer Chautauqua in Iowa City a success. We truly appreciate the enthusiasm, cooperation, and creativity you brought to our groups.

It is the freshness of your ideas and experiences that keeps the Chautauqua program alive and driving forward. Sharing these vital ideas with your colleagues is a vital component of S/T/S.

Thanks!
The Chautauqua Staff

Down the Road Ahead—

Future Workshop and Convention Calendar

October 15-17, 1987
NSTA Area Convention
Miami Beach, FL

October 22, 1987
ISTS Iowa Science Teachers Fall Conference
Stouffer Five Seasons Hotel
358 First Avenue, N.E.
Cedar Rapids, Iowa

November 5-7, 1987
NSTA Area Convention
Pittsburgh, PA

November 14, 1987
Iowa Electric Science Seminar
IE Tower
Cedar Rapids, Iowa

November 19-21, 1987
NSTA Area Convention (and CAST)
San Antonio, TX

April 7-10, 1988
Thirty-sixth National NSTA Convention
St. Louis, MO

Announcing: The 1987-88 Chautauqua Conference Schedule

Next year's Chautauqua Program promises to be eventful and intellectually stimulating. Tell your colleagues now; our courses are already filling up. Remember, STS is a team effort; send a friend.

October 16-17, 1987
March 4-5, 1988
Holiday Inn South
Des Moines, Iowa

October 23-24, 1987
March 11-12, 1988
Indian Hills Community College
Ottumwa, Iowa

October 30-31, 1987
April 15-16, 1988
Buena Vista College
Storm Lake, Iowa

November 13-14, 1987
April 22-23, 1988
Jumer's Castle Lodge
Bettendorf, Iowa

Iowa Summer STS Participants

Name/Address

Rebecca M. Andresen
Eisenhower School
Davenport, Iowa

Rollin Bannow
South East Junior High
Iowa City, Iowa

Sharon Bender
Prairie High School
Cedar Rapids, Iowa

Larry Berland
Decorah Junior High
Decorah, Iowa

Beth Bloom
Howe Elementary School
Des Moines, Iowa

Jill Bouslog
Lucas Elementary
Des Moines, Iowa

David L. Bowman
Carroll, Iowa

Larry D. Burrows
Sumner, Iowa

James E. Cool
Centerville High School
Centerville, Iowa

Gretchen Lee Deutschmann
Cono Christian School
Walker, Iowa

Rae Ann Dickinson
East Central School
Sabula, Iowa

David V. Dupee
Cono Christian School
Walker, Iowa

Nancy R. Edwards
Douglas Elementary
Des Moines, Iowa

Sheila Engel
Holy Family School
Davenport, Iowa

Thomas B. Ervin
Wood Junior High
Davenport, Iowa

Martha Farwell
Illinois City, Illinois

Martha J. Fenton
Van Allen Elementary
Chariton, Iowa

Deloris E. Ford
Hunt School
Sioux City, Iowa

Dorothy M. Hall
Adams Elementary School
Des Moines, Iowa

Marla Harter
Russell Elementary
Russell, Iowa

Judy Havnen
Barlow Granger Elementary
Des Moines, Iowa

Greg Hawk
Oxford Junction Consolidated
Oxford Junction, Iowa

Lynn Hodgeman
West Francis
Centerville, Iowa

Timothy R. Hughes
Carroll, Iowa

Mary A. Ira
Watrous Elementary
Des Moines, Iowa

Sharon Johnston
Webster City Junior High
Webster City, Iowa

Donna Kersten
St. Joseph School
Earling, Iowa

Tina Koepnick
Prairie High School
Cedar Rapids, Iowa

Eric Korpanty
Stilwell Junior High
West Des Moines, Iowa

Kenton Krusor
Winthrop, Iowa

Michael J. Marty
Hempstead High School
Dubuque, Iowa

Mark J. McCarthy
North Scott Junior High
Eldridge, Iowa

David McLaughlin
West High School
Iowa City, Iowa

Michael G. Miller
Fremont School
Fremont, Iowa

Vera L. Miller
Blakesburg Community School
Blakesburg, Iowa

Patricia L. Mothershead
Eddyville Community School
Eddyville, Iowa

Annette Norris
Woodside Middle School
Des Moines, Iowa

Robert G. O'Connell
Wahlert High School
Dubuque, Iowa

David Palmer
Bunger Intermediate
Evansdale, Iowa

Duane R. Proctor
Carroll Community High School
Carroll, Iowa

Dennis Reida
Chariton Community School District
Chariton, Iowa

Casey Reinkoester
Cono Christian School
Walker, Iowa

Irene Rockhold
Reynolds Grade School
Reynolds, Illinois

David C. Runyan
Postville Community Schools
Postville, Iowa

Ruth Smith
Chariton Community Schools
Chariton, Iowa

Robert H. Stanley
Andalusia School
Andalusia, Illinois

Kate Starostka
Studebaker School
Des Moines, Iowa

Robert L. Sweeney
Clive Elementary
Des Moines, Iowa

Roger C. Thiede
Dubuque, Iowa

Stan Thompson
Wilson School
Ottumwa, Iowa

Joe Toot
Nevada, Iowa

William Ward
University Park, Iowa

LaRee A. Wells
Reynolds Middle School
Reynolds, Illinois

Nancy Wright
Lincoln Elementary
Dubuque, Iowa

Donna Wynn
Hunt Elementary
Sioux City, Iowa

TEACHER-LEADERS, 1987

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K-6 Science Coordinator
Marshall Middle School
Marshall, Michigan

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Iowa City, Iowa

Ernest Schiller
Central Lee School
Argyle, Iowa

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Chautauqua
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Chautauqua Notes

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STS Builds Leadership

by Robert Yager

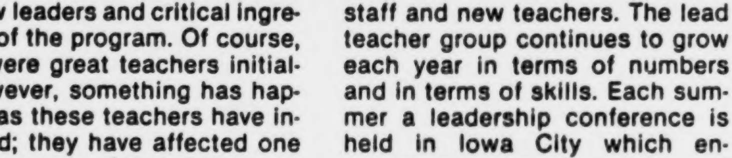
One of the most significant aspects of the Iowa Chautauqua Program has been the identification and growth of some most exceptional science teachers who are now leaders and critical ingredients of the program. Of course, most were great teachers initially. However, something has happened as these teachers have interacted; they have affected one another; some of their ideas and teaching strategies have coalesced.

The STS philosophy includes a reaching out, a searching, a use of others for their ideas and expertise. It starts with the idea that no one knows enough, has all the answers, has experienced perfection. It focuses on the fact that many share common goals, especially those that call for more student growth, better student attitude, more student creativity, more student ability to use the ideas and skills approached in science teaching.

One of the most important outcomes of Iowa Chautauqua is the network of teachers that has evolved, especially the network of lead teachers who inspire the staff and new teachers. The lead teacher group continues to grow each year in terms of numbers and in terms of skills. Each summer a leadership conference is held in Iowa City which encourages personal growth and revitalization, the refinement of the fall program itself, and the enlargement of the assessment efforts.

This issue of Chautauqua Notes includes examples of the lead teachers that the program includes. They share their ideas, perceptions, and concerns for all readers, especially the outstanding new group of teachers who are now part of the STS and the Chautauqua group.

STS builds leadership! Without such leaders, the program would not be half as effective as it is!



The Difference Between

by Joan I. McShane, Lead Teacher
Jefferson Elementary,
Davenport, IA

What is the difference between viewing a picture or painting a portrait, reading an aviation manual or piloting one's own airplane, watching a football game or scoring a touchdown, reading a poem or writing your own, teaching science traditionally or using an STS approach? All of these describe two very different experiences. None is as starkly different as the two approaches to science teaching.

During the two years I have been involved in the STS Chautauqua Program, I have found my science teaching to be exciting, stimulating, and productive. Both my students and I have discovered science classes now not only include pure science instruction and laboratory activities, but also how this knowledge can be utilized in our community. To put it simply, my students have come to realize that science is not only what happens second or third period in the school day, but also what occurs in their lives, both in and out of the school building. To me this is science education now and for the future.

Each year the University of Iowa Chautauqua Program improves the quality and quantity of

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its offerings. The state wide appeal of the Chautauquas speaks for itself in the numbers who attend a "summit" of Iowa science teachers. I am delighted with the 1987-88 teacher participants. It is intellectually stimulating to be with professionals who are interested in and trying to improve their teaching—"to be the best they can be"—to paraphrase the recruiting slogan of the United States Army. The summer program as well as the fall and spring Chautauquas provide these selected teachers opportunities to meet in small groups with the teacher leaders to interact, question, discuss, and commiserate. Eventually these participants share the results of their STS teaching. It is this sharing of successes that makes the Chautauquas so rewarding for ALL of us! As everyone knows, success builds on success. STS must be succeeding, as enthusiasm for it is increasing. Teachers used to ask, "What is STS?" Now the question usually is, "Are you involved with STS teaching?"

I am excited about the ongoing activities of the University of Iowa STS Chautauquas. The Iowa Utility support tells me that Iowa industry is interested in science education. The quality of the Chautauqua participant tells me dedicated science teachers want to improve the science education of Iowa's youth. Looking at this mixture of components tells me this is a winning combination. IT IS STS!

I am looking forward to the time when STS is found in the curriculum guides in every school district in the state of Iowa as well as in every science classroom. Then, I believe, the "difference between" will be considerably narrowed.

STS Teachers Can Make A Difference

by Curtis Jeffryes, Lead Teacher
Cromwell Elementary
Creston, IA

It seems a short time ago, yet an eternity, that I became involved with the Chautauqua program and STS. I can remember vividly the confusion and frustration that all the early participants felt when trying to wrestle with what STS was and how we were going to incorporate it into our science classes.

All of us in the program were searching for something better and we recognized there was substance in STS. Our frustration was compounded because we had to find direction ourselves rather than have others lead us down a predictable, guided path.

The direction that STS and the Chautauquas go in the future is up to all of us.

At the time it was maddening, but in retrospect it was probably the only way to go. What evolved from this was a Chautauqua and STS philosophy created by classroom teachers, the University of Iowa, and the Iowa Utility Association.

This unique partnership has given birth to a movement in science education in Iowa that is quickly gaining momentum. Each year the Chautauquas grow stronger and the quality of products coming from them has increased dramatically. The growing success of the Chautauquas is a direct result of how well this cooperative effort works.

Another fascinating part of this program has been the professional growth of the classroom teachers during the first three years of the program. Through the encouragement of the Iowa staff and the support of the utility companies, teachers in the program have become involved in science education in a way none of us could have ever imagined.

Who would have ever thought that we would be doing radio and television interviews, writing articles for publication, presenting at national conventions, designing and leading Chautauquas, explaining what we do to science education experts, helping with STS testing research, and so forth?

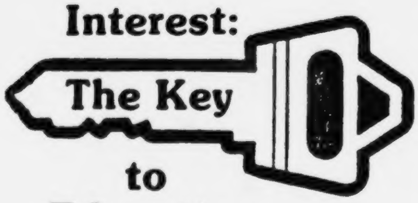
My professional growth as a science educator is still somewhat mind-boggling. I didn't know that part of me even existed three years ago. It has now created a purpose for my teaching career and reaffirmed my commitment as an educator.

Teachers often complain that no one ever listens to what they say, or values their opinions. In the Iowa Chautauqua teachers are heard and their opinions do count. We have definitely had an effect on the Chautauquas and on the way STS is being presented in this state.

The direction that STS and the Chautauquas go in the future is up to all of us. The University of Iowa and the Iowa Utility Association have made their commitment and we lead teachers have made ours. How about you - the new class of Chautauquans? If you want your voice to be heard, make the commitment. You can make a difference!

It's Coming—Be Prepared

Are you ready for **National Science and Technology Week?** Plan something special with your students and do it during the week of April 24-30. It is a week set aside especially for STS ideas and projects. Watch for more information next month.



Interest: The Key to Education

by Morgan Masters, Lead Teacher
Chariton Community Schools
Chariton, IA

I was first exposed to the "STS" bug at a University of Iowa/Industry-sponsored Fall Chautauqua workshop in the fall of, 1985. It was truly a turning point in my understanding and identifying the philosophy by which I approached science instruction. I had finally found a meaningful and logical approach to teaching science concepts, while keeping students' interests and enthusiasm high. The STS philosophy seems to fulfill the adage, "Interest is the Key to Education".

Before Science/Technology/-Society (B/STS), I entertained my students from time-to-time with interesting activities, but usually only when time allowed, or it seemed appropriate and related to the established curriculum time-line or it followed the chapters of the book. An occasional field trip or visitation from a community resource brightened our day, but then it was back to "Science", via the textbook, film and worksheets. "I" was the major provider of information, resource and decider of what was or was not important and necessary for learning.

I loved the days when we talked about how our community was affected by science concepts or the newest this or that discovered by NASA in this morning's newspaper and the way things work in real life. I also noticed that students seemed to feel the same way. But, remember, science should not be fun and games—or so I thought.

Then through my exposure to STS I found I could combine all those science facts and concepts with the community and societal issues and the technology available into a big bundle of "good stuff", which appealed to students. As a result, I truly love coming to school everyday and I think a lot of students enjoy science class much more. "Interest is the Key to Education".

STS have given me the opportunity to expose student to the real world while learning the major concepts of physical science. Students need to know how concepts are applied to real life situations. There is more enthusiasm and total participation in the activities and projects that surround the concepts we explore. Students seem to work harder at investigating and understanding. Parents show more interest in their son's or daughter's science assignments. Community involvement from all aspects has increased. Students have learned they are important and can make contributions to decision-making situations in our community.

The Chautauqua Progam has changed over the time of my involvement and those changes have all been positive. The "teachers helping teachers" philosophy now used in our workshops seems to help to better bond instructors together in terms of communications and sharing instructional philosophy and ideas.

Every time I am exposed to a new group of teacher participants in our Chautauqau Program I am impressed by the talents and innovative ideas they possess. Providing the opportunity for so many enthusiastic professional educators to get together is in itself rewarding. The support shown by the University of Iowa, the Iowa Utility Association and other organizations help instill confidence to all of our participants.

Looking to the future of our Chautauqua Program, I would like to see more opportunities for teachers getting together to share their successes and failures during the year. Possible for just one-day get-togethers in a two or three county areas, for example. The sharing of ideas with colleagues is very valuable. I would also like to see our program expand outside of Iowa to our neighboring states. The larger the number of educators, the greater the input of shared ideas and success stories.

"Open Door" Policy

by Ed Rezabek, Lead Teacher
Glidden Ralston Comm. Schools
Glidden, IA

In kindergarten and in the first few years of school we have a very curious, questioning, inventive child entering the world of "education". What do we do with this curiosity?

Kindergarteners really learn all they need to know to live in kindergarten!! Wisdom is not found at the end of the line when you receive your diploma for this degree or that degree.

What do you need to know? Share everything. Play fair. Don't hit people. Put things back where you got them. Clean up your own mess. Don't take things that aren't yours. Say your sorry when you hurt somebody. Wash your hands before you eat. Learn some and think some and have some fun once in a while. Take a nap in the afternoon. Hold hands and stick together. Watch out for traffic. Be aware-ask questions. Remember the little seed in the plastic cup? The roots go down and the plant comes up. Nobody really knows why, but we are all like that. (Idea borrowed from Robert Fulghum-Kansas City Times [September 17, '86]).

Remember Dick and Jane? The key word they tried to teach us was LOOK. Everything you need to know is found somewhere.

Remember one of the objectives of STS is to open doors for our students enabling them to have a better LOOK at the world. How we go about this is an individual thing. The key point is that we open them—let the students close them when it's

(continued on page 4)

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time.

One of the most difficult parts of adapting to the STS philosophy is to leave the doors open. Just because we spend two whole days on the water cycle doesn't mean that its time for a test and then move on to something else in the curriculum guide.

You have a plan in mind to teach a certain topic. Fine. Now, what/how would the kids like to learn about the topic? How do you find out? What can you do to expand on an area of study? The teacher/facilitator, can find this kind of information out and make the kids feel like they have a role in selecting what to study in science.

Start off with a brainstorming session on the topic that is to be studied. Let's say you want to study Nuclear Energy. Find out what the kids know about the topic and get them in a frame of mind for the topic. Individually, have the students make up a question(s) they have concerning the topic. This might be presented as "What do you wonder about when I mention Nuclear Energy?" Give them a few minutes to think about this. Next have them get together with one or two other classmates and discuss their questions in small groups. Have the group write up their questions on larger pieces of paper. Construction paper and markers work well for this. Each group then posts the set of questions in the room. These can be taped up, pinned up, or in some way made visible to the entire class. Each student then walks around the room and looks over the variety of questions that have been posed and has the task of selecting the one question that he/she would be interested in researching. (If there is more than one of interest let them choose a couple) The students choice(s) then are turned into the teacher and ideas are explored for further research.

This is a good time to work through the process of researching and reporting information. Make arrangements with the person in charge of such information in your building. Take the students to the library and have a session on library use and finding information.

Allow the students ample time to complete their research. Have the students report on their findings. Be creative in how this is done, video taped television specials, student demonstrations to lower grades, etc.

Now you as the teacher/facilitator have a springboard. Your students have given you ideas on what is of interest to them concerning the direction you have chosen. Adjust your teaching to the needs of the students!

Open yourself up to the kids. Open the doors and have a look. They do have questions of importance to them. You don't have to feed them information. Let them feed themselves!

What kinds of questions do kids ask? Will this help my grade? Does spelling count? Are you going to grade this? Should we write this down? Did you get a haircut? Did I miss anything? or did you do anything important while I was out?!!! Is this going to take the whole period? WHY DO WE HAVE TO LEARN THIS? These are the kinds of questions kids typically ask. Kindergarteners don't care about grades, spelling, how long it will take, what the teacher philosophy is. They care about what ever it is they are curious about.

But it is possible to return some of the curiosity and wonderment we all experienced as 5 year olds. STS can help open some doors which have been long closed by more traditional educational systems. **You are the key!**

STS can help open some doors which have been long closed by more traditional educational systems. **You are the key!**

TRY THIS!

Make sure you keep your administrator informed and up to date on the STS project the students are doing. The students can do this for you. A weekly report generated by the class is perfect to send to the principal's office. The report should reflect what has happened in science during the week. Send along a copy of the articles the class discussed or research done by the students. Every once in awhile video tape a class and invite the principal in to view it with the students at the end of the week.

Enthusiastic Teacher Reactions

by Rae Ann Dickinson
East Central Schools

STS, student-planned curriculum, relevant topics, technological advancement, environment, energy, water, air! It's all swirling, whirling, buzzing, fuzzing up my brain!

Even though I'm in my second year as a Chautauqua participant, I am still feeling the excitement of a rookie! After the attempt to teach my first STS unit last spring, I realized there were mistakes made, changes needed, ideas to build on.

Last summer, more STS ideas were added to my already overflowing consciousness.

Even though I haven't "rewritten" each of my science units that I present during the course of the school year, I'm a changed person. I no longer look at science as curriculum to be taught, but rather, life to be experienced! Since I have entered the realm of STS, my science teaching has not been the same.

Recently, when mentioning an upcoming field trip to our local arboretum to further our studies of plant life cycles, one of my students said, spontaneously, "Gee, why do we do so many fun things in here?" Speechless, I just smiled.

STS and Chautauqua: Rings of Hope for Teachers

by Larry Beeson, Lead Teacher
North High School
Sioux City, IA

In these days of trying to compete with 1,000 other things a student would rather do, I have found that the Chautauqua and STS programs are rings of hope for teachers.

In Chautauqua, I like the idea of gettng together with not just teachers from my regions, but from the state as a whole, even from other states. I enjoy being able to exchange ideas that work in the classroom with other teachers. All too often, we as teachers isolate ourselves from our greatest resource—other classroom teachers.

From fellow teachers I have met through the Chautauqua program I have found that they have the same problems I have had in the classroom. Through these exchanges, I am amazed at the many good ideas that have come up to solve these classroom situations.

As for STS, it has changed my way of thinking of myself as a teacher. I guess I thought of myself as a dispenser of knowledge. I would give the students the concept (which I felt they couldn't go on through life without) and they would be able to understand and adapt it to any issue of advance that would enter into their lives. I had one problem with that line of thought—it wasn't working out as good as I wanted.

With STS, I can let the students have some say in what they feel is important to know or what they feel is important to their lives. If I can get them to establish ownership, that it was their idea to learn the concept, I can get better understanding. With the use of tech advances and social issues that are important to the students, STS gives me a multi-prong attack to get better understanding. Now I feel I'm more of a questioner or prober of knowledge, rather than a dispenser of it.

In my view, the biggest change in the Chautauqua format is being able to get the concept of STS from the "talked-about stage" at the workshops to the "use it" stage in the classroom. I feel this has been done by the teacher leaders and the staff of Chautauqua by showing and sharing teaching ideas with the teacher participants.

I see the program getting stronger each year with the quality of teachers we are getting to participate in the workshops. With each new group of teacher participants, we are getting people who are more informed regarding STS and Chautuaqua. I really feel the word is getting out.

Exchanging STS Ideas

by Jeanne Rogis, Lead Teacher
Central Comm. Jr. High School
Dewitt, IA

How many times does a science teacher in rural Iowa have an opportunity to meet with other science teachers and exchange ideas? The answer is simple—as often as a University of Iowa Chautauqua is taking place! The opportunity for the exchange of new classroom ideas is the most important facet of the Chautauqua program to me. Without the Chautauquas it would have been very difficult for me to have incorporated the STS philosophy into my science classes. STS projects have served as excellent motivators for my classes during the past few years. STS seems to provide the tool necessary for making science relevant to my students' lives. Using the STS philosophy my students have compared different types of insulation for homes and related it to heating costs. We have compared natural dyes to commercially-prepared dyes and came to the conclusion that technology has certainly made "dying" easier! We opened a study of ocean currents by making ice cream and comparing the change in temperature of ice covered with salt with plain ice. We then related this to density currents and the effect on our climate and food supply. We also used the pumpkin patch and later a vegetable garden to explore agricultural practices of the past and their effect on the future. All of these projects had their effect on the future. All of these projects had their beginning in presentation or conversations from the Chautauqua Program.

In my years of association with Chautauqua Program I feel that one of the most positive changes that has come about is the support given by the Iowa Utility Association. The teaching materials which they have furnished have supplied many new ideas to each participant. Their materials, as well as their funding and support for the entire program have been invaluable.

I feel that once again we have started on a very exciting program of creating new STS modules. Each new participant

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offers their own flavor to each Chautauqua and in so doing, enhances the program. The Chautauqua Program would soon become very monotonous if it weren't for the individual personalities involved. It has certainly been a privilege to know and work with these different personalities and programs through the years.

A stronger communication network has developed between all facets of the program. It is important that we keep communication open. There should be opportunities for participants to communicate with the staff and the other participants. I feel that more articles should be included in each newsletter which have been generated by the present participants. Perhaps even a Saturday when participants could meet together halfway between Chautauqua sessions would provide some welcome dialogue.

I can foresee the Chautauqua Program continuing to grow in the next several years. With this growth I feel the need for better communication will become even greater. We are standing on the edge of a very exciting time in science education. STS modules are certainly a good way to make science much more relevant.

A Letter to All STS Teachers

by Ernest Schiller
Central Lee School   Argyle, IA

As a lead teacher at the Bettendorf Chautauqua in November, I witnessed an infusion of ideas and excitement about developing a new project relating to science content presently taught, but including societal issues and related technology. Several of the workshop participants were on campus at the University of Iowa last summer where an initial introduction was given to STS. Those participants came to Bettendorf prepared to share their STS projects already included in their curriculum.

The summer participants blended well with the new workshop enrollees. A lot of good discussion and brainstorming led to a raft of creative ideas. Spring '88 in Bettendorf will be exciting when we view the completed projects and share the evaluations of STS science classrooms.

Good luck to all the STS teachers as you unveil your projects in your classrooms.

Science Education: Memorization and Regurgitation

by Jennifer Horn, Research Assistant

Here I am, sitting in the middle of the University of Iowa's science education department, trying to ingest and disgest the information and ideas about STS that are being introduced to me (I did find out that STS stands for Science/Technology/Society). Being an undergraduate new to the Chautauqua Project, it seems appropriate that I should look at my own experience in science to help get an idea of the direction I should be heading. So I tip back in my chair that tilts, swivels, and rolls and reflect on the hours of my life spent so far in science classes.

My in-school science education didn't really exist until fourth grade, and, even then, I'm not too sure it existed. The class loved to get out of school for the field trips to take walks through the nature preserve, but learning the difference between red and white oaks doesn't take too much thought. We were introduced to microscopes in fifth grade: we got the light-weight, blue plastic scientific instruments out of the cabinets and weren't too sure what to do with them. Nothing much happened in the sixth grade classroom, either, but I did learn about the human brain in the Talented and Gifted program. This experience was a big step forward, because we were encouraged to be curious and ask questions, to think for ourselves.

Finally, in junior high, there were entire class periods devoted to science, and I went on to take four more years of science courses in high school. Notice, though, that I said there were class periods devoted to science—I didn't say devoted to *learning, understanding, or thinking* about science. For the most part, my classes were devoted to memorizing scientific information and then worrying about whether or not I'd be able to regurgitate my notes word-for-word when I took the tests.

However, there were a couple of exceptions to this rule of memorization and regurgitation. The classes that everyone complained about the most. Why? Because we were expected to think, to make connections on our own; and that takes a little more energy than memorization. The tests we all dreaded were the ones that described experiments we hadn't talked about in class and then expected that we'd accumulated the information and analytic skills enough to make the right conclusions. In the end, these tests turned out to be most worthwhile, and sometimes even a little fun, because we had lively discussion (which sometimes led to heated debates) over the right answers. We all learned, because we had to explain our reasoning; and to do that, we had to know the material thoroughly.

While there were a couple classes in which it was necessary to use my mind to do things other than just memorize, there were very few situations that called for creativity. Without creativity, students often become bored, and boredom often leads to negative educational experience. This is why I'm excited about the goals of the Chautauqua Project as it searches out and utilizes both creative teaching approaches and creative evaluation methods. It will alleviate boredom and turn out more interested and better-educated students, and with my college goals, I hope to be able to help. At present, I am planning to study English and science education with emphasis in creative writing and physics. Creative lab reports? Narratives about the travels of a wave? Who knows? But I'll try to get rid of this memorization and regurgitation stuff.

Before and After STS

by James Canfield, Lead Teacher
Fairfield Junior High School
Fairfield, IA

This will be my second full year in the Chautauqua Program, and things have changed drastically in my classes. Before STS, I started each year with a "Mr. C list of 5,000 things needed to know about Earth Science", believing that these would be useful someday. I think the one fact that shocked me more than any other was my first summer Chautauqua Program, listening to Dr. Penick and his survey on preferences. Being so close to the problem, it is sometime difficult to see there is a problem. How often have you heard, "When will I ever use this?" or "Why do we need to know this?" The further students advance in school, the less they seem to like Science. This also corresponds to the fact that their teacher is more specialized possessing a better science education, or has more science knowledge.

I recall some of my elementary teachers-science was the subject they liked the least, or so it seemed. because we did science only if there was time, and often there was no time. With this in mind, I have tried to alter the way I approach a new Earth Science class. No longer do I start out believing I am the fountain of knowledge that will lead them out of the darkness into the light.

Many of the topics we now study relate to the student's needs and current social issues. Some of the main issues in our town today include the water system, along with ground water. The city is battling a rural water system, as well as attempting to meet the new state standards for water. Many of our students are rural, and have their own wells. They are reading more and more about ground water contamination.

The city students vs. the rural students on water issues presents an interesting dilemma. Even at this age, they realize that there is a cost factor: Who pays the bill? How clean can we have our water? How clean must our water be?

Over the past unit, we have had outside speakers relate to the class on ag chemicals in water, purifying water machines, city water, the State of Iowa Department of R.C.D., and a county representative. Each of these speakers presented interesting ideas to the students and at the end of their talk, the students had the opportunity for 10-15 minutes of questioning. Often their questions related to earlier speakers or what they had mentioned. The students could readily grasp the importance of what they were learning and how it will affect their lives in the future. We even have a few students that want to educate other students concerning what is happening to their water. They have also mentioned writing letters to the editor of our local newspaper.

I think one of the most difficult tasks will be cutting off the unit. This students do not want to end this work. This definitely is a pleasant surprise! All I hear previously was, "When are we going to be finished with this stuff?" or "How will I ever use this information?" Now it is, "Do we have to end this?" I feel this becomes a key factor in getting them to keep exploring ideas: because they want to, and not solely because their teacher thinks it is useful.

Editor's Corner

This is the way it should be from now on - hardly enough room for the editor to say a few words. I am delighted to see so many teacher authored articles in this issue. Your excitement and enthusiasm for STS are reflected in the thoughts and ideas you have shared. Thank you for the extra time during this busy season. I hope to have less room next time! Keep sending articles for future issues.

It is important for you to remember that STS works best when you work with your students as learners. Every new year brings many opportunities to grow and learn more. Don't let these chances slip by in the future for you or your students. Just think:

"While there is no guarantee that life *will* be better in the future, it *can* be better. We possess the tools and the know-how to feed the world's peoples, to communicate better, to build better environments, to educate everyone, to provide better medical care, even to entertain ourselves better. The question is not whether we can do these things, but whether we will and when."

Outlook '87, World Future Society

Susan Blunck
Program Coordinator

STS: Science for Tomorrow

by Gary Jensen, Lead Teacher
Roland Story Middle School
Roland, IA

"There is so much to learn, is a statement often heard from the older generation. I believe this is a statement that is finally being considered by most veteran science teachers. We are told by the experts in statistics that we, on the average, are instructing more future criminals than future scientists in our classrooms. What is a science teacher to do? I've done things in my classroom to get the student's attention each day-but only the ones interested in science get excited

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about the lesson using this technique. Are we really getting to each one the best that we can?

Experienced teachers have come to the stage in their instruction that haunts them again and again. Are we spending too much time on aviation and not enough on the DNA molecule? It's the old scope and sequence argument-get a little bit of everything. Of course that is impossible. My science teaching has arrived back to the Edison school of practicality-almost the one room school theory. Let the students teach each other. If what I'm teaching is so important, then why can't most of the students be interested or turned on by the very nature of their curious selves? I've come to the conclusion that if the subject is not relevant to their life, then science is just a gimmick (and this, too shall pass). I've arrived at the realization that what we are doing in class needs to be important to each student. It has to be a matter of personal pride and an issue that the student wants to tackle. The student will take on a project if the student feels that his opinion counts as much as everyone's. I think the STS model has the right emphasis to teach by project and issues. I start with the concrete and stay in that realm unless an individual student needs to move into the abstract. As a teacher, I see the projects roll in and the many questions the students ask. I know that I finally have hit on something that I feel is indeed the right thing to be doing with the student's time. It makes the student feel that his opinion is important and that he matters in the things that he sees and lives. Start with a little and work more and more STS into the classroom. It will be uncomfortable at first because we are not the experts the students think we are. Our role as a facilitator and learner will be visualized by the student. The student as a researcher and decision maker equips them for the unknown future. They learn to find and process information that seems important to them.

Present STS philosophy as I see it, allows the instructor to arrive at a local issue to study. Newspapers are full of articles about technology, science, and society for a science class to investigate. The issue the teacher choose to work at can take the class through as many science concepts as the imagination and the student's will allow. I believe STS is an approach on which to base teaching. "Teacher-proof" materials have been suggested but I think it is much more valuable to find my own materials in periodical literature of today. This is risky teaching compared to ready-made material to which we have become accustomed. There is a surprising amount and quality of material the students will accumulate to research the issue. I find my teaching has become much richer by using the STS philosophy and more enjoyable since it is not just another class to be taught in the same way as all the other years. The STS idea is very old, yet for today, very new-the science for tomorrow.

Rich STS Resources

by Joseph G. Lindquist

In the October newsletter, I talked at length about the use of resources. Since writing the article, a couple of good suggestions have came to mind on how to obtain resources. These are ones shared with me some time ago. One suggestion ties closely with two frustrations I faced while teaching at my former school. This school had a library with almost no science periodicals, past or present. I also had some students, who given the opportunity, would take the time to look at and read science magazines. A suggestion to help with these, and other, related problems is to ask community people to donate past issues of magazines like *National Geographic*, *Discover*, *Time*, etc. Some of us have probably even visited friends or relatives who subscribe to a magazine like *National Geographic* and who just can't seem to throw the darn back issues away. There these people are with back issues stacked to the ceiling, just looking for good place to donate them. Offer your room (or school library) as a place to donate them.

A colleague shared another good idea. To meet some of her classroom supply needs, she would list in the local newspaper needs she felt community people could help meet. Now what a great idea!! Not only would this work in obtaining aquariums, tools, and broken appliances but also magazines and newspapers (not to mention the possible positive PR).

Resources—what excellent things to share with others. Christmas—an opportunity to share special time with family and friends. Chautauqua—what an excellent way for teachers to share exciting classroom experiences with other teachers. Three fine words—relevant not only in this busy, yet special, holiday season but all year round. Happy holiday to you and yours in this time of sharing. I hope the new calendar year gives you lots of reasons to continue the Christmas theme of sharing!

Technology Review—(Monthly magazine edited by staff at MIT)
P.O. Box 978
Farmingdale, NY 11737-9878

The Hastings Center Report—(Bimonthly magazine dealing with education and research programs on ethical issues in medicine, the life sciences, and the professions)
The Hasting Center
255 Elm Road
Briarcliff Manor, NY 10510

State of the World 1988—(Manuscript which provides hard hitting assessments of global resource management)
Worldwatch Institute
1776 Massachussetts Ave., NW
Washington, DC 20077-6628
(202) 452-1999

Teacher's Clearinghouse for Science & Society Education Newsletters
210 East 77th St.
New York, NY 10021

Ocean Prospects: A High School Teacher's Guide for Ocean Related Topics.—C.M. Plummer ($1 pamphlet which covers dif-

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ferent topics with lists of resources included.)
Virginia Sea Grant College Program
Virginia Institue of Marine Sciences
The College of William & Mary
Gloucester Point, VA 23062

Iowa Conservation Education Council—(Membership information)
Route 1, Box 53
Guthrie Center, IA 50115

A Whack on the Side of the Head, A Kick in the Seat of the Pants—(2 books dealing with creativity and innovation) Both by Roger von Oech

American Red Cross—(Aids information and workshops)
Hawkeye Chapter
2530 University Ave.
Waterloo, IA 50701
(319) 234-6831

ANNOUNCING

The Third National Technological Literacy Conference: Technology, Democracy, and Development once again, the TLC will take place at the Marriot Crystal Gateway Hotel, right across from the nation's capital in Arlington, Virginia, February 5-8, 1988. As in past years there will be comprehensive coverage of developments in STS education and technological literacy at K-12, college, and adult education levels. For more information contact Leonard Waks, Program Chair, STS Program, Penn State University (814) 865-9951.

Acquired Immune Deficiency Syndrome and STS

by Ernest Schiller, Lead Teacher
Central Lee School
Argyle, IA

One of the most successful STS units I developed was a recent unit on the "AIDS Dilemma". While studying viral organisms in biology, the students began to ask how the AIDS virus relates to the typical diseases that viruses cause. Not knowing very much about the AIDS virus, I put it into the hands of the students and turned it into a STS project.

The students researched current publication that included magazines and newspapers. They reviewed brochures and pamphlets distributed by area doctors and the county health nurse. They searched these articles to determine the truths and falsehoods that appear in these articles. Even though the student's knowledge in the area of "AIDS" was limited, they found a lot of inconsistencies in the various articles that were published. They categorized what was true from these articles. They categorized inferences from the stories and news clips. They soon determined that all that one reads is not necessarily true.

One of the most successful STS units I developed was a recent unit on the "AIDS Dilemma".

The students also found that even television was carrying a lot of news stories and programs about AIDS education. Several were taped by the students and were brought in. After previewing these, several were brought into the class to be used as resource.

The students probably learned more about a disease and the problems that the victims and their families face than simply talking about viral infections. Discussions led students to investigate their own value standards. They know that during their life, they may encounter an "AIDS" victim in their school, church, or community. Hopefully, they have obtained a few facts about what the medical community feels is known about the disease. They are aware of problems associated with developing technology to cure or prevent the disease. They have definitely discovered the societal implications associated with this viral disease.

Applications of Scientific Principles

by Catherine Cook, Research Assistant

Recently, I took a test dealing with the Science Process Domain. What kind of a test is this? The questions give you a statement and the test taker is supposed to use that information to draw a conclusion. For example, Given: the hotter the water, the faster the sugar will dissolve. Below this statement are four jars, each with a different temperature and a different dissolving time. At first approach, we might assume that the jar with the higher temperature would be the one in which the sugar would dissolve the fastest. However, we also have to consider the amount that we want to be dissolved. Therefore, the answer is not based on merely the temperature, but the dissolving time instead, because the dissolving time includes the temperature when it is figured out.

This test was geared for students in grades seven to nine. I confidently took the test, assuming I would easily know all of the answers. After all, I am a college student and this test was set up for students four years my junior. I incorrectly answered a few questions. This startling revelation is what prompted me to write about my high school science education, or rather, lack of. Perhaps by learning about what I feel I missed, other students as well as teachers will benefit in some way.

Looking back on my high school science education, I find a tremendous void. I remember taking courses such as biology, chemistry and physics, but the in-

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formation obtained through these classes has almost completely vanished. One could argue that the reason this information has left me is due to the fact that I took some of these courses many years ago. However, I must strongly disagree. The reason I have found for this loss of memory stems back to the emphasis placed upon facts. Why would anyone want to remember mere facts when they don't pertain to real life situations? Take courses like Family Living or Marriage and Divorce if you want a course that deals with life, is the answer many hastily offer. Colleges want students who take courses where factual information is learned. Unfortunately, the goal of students is to appear a Renaissance person on college applications. They take these science courses and come out of them with not much more than a few useless equations scrambled in their heads. The reason I feel college de-emphasizes the need for skills dealing with life, or more specifically, the need to show how science relates to the world we live in can be blamed on an inadequate testing system. How can we test for creativity? How can we test if a person has learned to cope better as a result of learning scientific principles and relative applications of these principles? Unbeknownst to many, science can be an integral part in bridging the gap between life and facts. The possibilities are endless. I hope by writing about my science experiences in high school that my point has been made. Science is not just a bunch of facts, but an important part of everyday life.

Holiday Smorgasboard – A Sampling of Thoughts

by Joseph G. Lindquist

The fall Chautauqua workshops are completed, I'm up to my eyeballs in work, basketball season is in full stride, and a small-town Michigan Christmas is waiting for me just around the corner—WOW!!—it must be December already. I hope everyone's school year has gone well up to this point!

During the course of the next few paragraphs, I will be lightly touching bases on a couple of different topics. The first of these topics will be a short introduction of two young ladies who are working here in the science education center as undergraduate research assistants.

> *Simpson defines science as "an exploration of the material universe, seeking explanations of objects and events; but the explanations must be testable".*

Cathy Cooke and Jennifer Horn are two freshmen who, along with a few other classmates, earned the right to work as undergraduate research assistants in various departments across campus. Cathy comes to us via the fine state of New York. She attended school in Wantagh, NY, finishing with a fine track record both in the classroom and in co-curricular activities. Cathy has a strong interest in science, reflected in her past coursework, her current enrollment in the pre-pharmacy program, and her interest in science education. These factors and her fine personality have made her an interesting source of information regarding how science is taught. When I asked about her family, Cathy's eyes sparkled as soon as she started talking about her parents. Cathy is obviously proud of them. She mentioned, too, that her grandparents live here in the state of Iowa—so she does have an Iowa connection.

Jennifer Horn calls Darien, Illinois her home although she, too, has an Iowa connection. Jennifer's connection is that she is originally from Dubuque. Her family moved to suburban Chicago during her sophomore year in high school. Like Cathy, Jennifer has a fine academic and activity track record. She is a National Merit Scholar with a strong background in science. While here at the University, she plans on double majoring, both in english and physics, with the hopes of being able to someday combine the two areas as a secondary teacher. (Definite STS potential here!) Jennifer speaks enthusiastically about her family which includes her parents and a 15 year old brother.

Due partly to their backgrounds and I'm sure partly to their office being located here in the science education center, both of these young ladies were very inquisitive about the Chautauqua Program and STS. Well this answer leads to another question which lead to more questions and answers until eventually the discussion evolved to the point where I asked the two young ladies to review the evaluation packet we had given to this fall's workshop participants and then share with all of us some overall thoughts on their K-12 science experience. Their articles are found in this issue. Please read, enjoy, and then share with us your comments.

In mid-November, Susan, Dr. Yager, and myself gave what turned out to be a two hour seminar to interested faculty and graduate students here at the Science Education Center. We talked about what STS meant to us, the philosophy behind the Chautauqua Program, and shared some of projects undertaken by participants in the Program. Some interesting dialogue resulted. One point stemming from this dialogue was regarding the real definition of "science" (and if

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there is just one?). This ended up to be good food for thought.

Helped by information supplied by some staff people, I've come up with a couple of definitions of science that I'll share. Some of the workshop participants will remember Dr. Yager's reference to George Gaylord Simpson's definition of science. Simpson defines science as "an exploration of the material universe, seeking explanation of objects and events; but the explanations must be testable". Another definition is one I remember learning as a secondary student. Science was defined as "the study of nature".

A third definition is one from a reading in my "meaning of science" course. A philosopher by the name of Norman Campbell stated science is "the study of those judgements concerning which universal agreement can be obtained". In this same reading, Campbell also mentions two forms of science which I found interesting. One form is that science is a body of useful and practical knowledge and a method of obtaining it. The second is that science is a pure intellectual study with little or no direct tie with practical life, either good or bad. According to Campbell, this second form is more akin to painting, sculpture, or literature.

I'm sure these are not all the definitions of science that exist. With this lack of consensus on a definition, I'm reminded of something I had learned awhile back about communication. In order to really communicate well, or even at all, with other people, you have to be talking the same language. One has to wonder how many misunderstandings of intent and/or meaning resulted from terms/phrases, like science, which were interpreted differently by different people.

If any of you have other definitions of science you would be willing to share, please send them to me. I'd love to share them in upcoming newsletters.

The 1987-88 Spring Chautauqua Schedule

March 4-5, 1988
Holiday Inn South
Des Moines, IA

March 11-12, 1988
Indian Hills Community College
Ottumwa, IA

April 15-16, 1988
Buena Vista College
Storm Lake, IA

April 22-23, 1988
Jumer's Castle Lodge
Bettendorf, IA

Down The Road Ahead

Future Workshop and Convention Calendar

January 15-16, 1988
State Meeting
Iowa Conservation Education Council
Guthrie Center, IA

February 5-7, 1988
National Meeting
Third National Science, Technology, Society (STS) Conference
"Technological Literacy"
Arlington, VA

February 11-16, 1988
National Meeting
AAAS
Boston, MA

April 7-10, 1988
National Meeting
National Science Supervisors Association
St. Louis, MO

April 7-10, 1988
National Meeting
Thirty-Sixth National NSTA Convention
St. Louis, MO

April 21-23, 1988
State Meeting
Iowa Academy of Science
Ames, IA

April 21-23, 1988
State Meeting
Iowa Science Teachers
Ames, IA

April 24-30, 1988
Be Prepared For:
National Science & Technology Week '88

Birthdays of Scientists

—January—

1 Eugene DeMareay
2 Johann Titius 1729
Isaac Asimov 1920
3 William Morgan 1906
4 Wilhelm Beer 1797
5 Joseph Erlanger
6 Jacques Montgolifier 1745
7 Eilhardt Mitscherlich 1794
8 Walther Bothe 1891
9 Har Khorana 1922
10 Robert Woodrow Wilson
John Martin Schaeberle
11 Nicholaus Steno 1638
12 Jan Baptista van Helmont 1580
13 Wilhelm Wien 1864
14 Matthew Maury 1806
15 William Prout 1785
Warren De La Rue 1889
16 Leonor Michaelis 1875
17 Benjamin Franklin 1706
Rober Hare 1781
James Hall 1761
18 Kaspar Wolff 1733
19 Sir Henry Bessemer 1813
James Watt 1736
Johann Bode 1747
20 Simon Marius 1573
21 John Fitch 1743
22 Francis Bacon 1561
Andre Ampere 1775
23 Carl Claus 1796
Adrija Mohorovicic 1857
24 Ferdinand Cohn 1828
25 Robert Boyle 1627
Joseph Lagrange 1736
Beno Gutenberg 1960
26 Ben Mottelson 1926
27 Victor Goldschmidt 1888
Hyman Rickover 1900
28 Johannes Hevelius 1611
Auguste Piccard 1884
29 Friedrich Mohs 1773
Daniel Bernoulli 1700
30 May Theiler 1899
31 Theodore Richards 1868

Chautauqua Notes Staff:
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APPENDIX VII

PUBLISHED MANUSCRIPTS PROVIDING RATIONALE AND ASSESSMENT RESULTS FOR STS IN IOWA

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BSO 200-460,20

NEEDED: NEW FOCUS AND PURPOSE IN SCIENCE EDUCATION

Robert E. Yager

Science Education Center, The University of Iowa, Iowa City, Iowa U.S.A.

Received: 1987-02-27

Science education has become a central concern among leaders and the general public across the world. In the U.S. this situation is dramatically different from the situation that existed five years ago. This period of change has stimulated much study, debate, research, and writing that is useful in describing needed directions and correctives as a new decade approaches.

Evidence arising from surveys of common practices, national assessments of student achievement and attitudes, synthesis of reports urging reform, and ethnographic studies suggests a new focus for school science. Basic to this focus is a science experience that emphasizes personal relevance. A program which builds from current issues and student questions is suggested. A program that encourages curiosity and direct student involvement as actions are contemplated is described. Such student involvement demands the information basic to science. The new focus emphasizes content that is needed and can be used as opposed to that which the teacher and/or school maintains will be useful.

Project Synthesis,[1] funded by the National Science Foundation in 1977, was a comprehensive research effort designed to identify discrepancies between the actual situation and a desired one with respect to school science. Information from the Third Assessment of Science[2] and information from the three Status Studies funded by the National Science Foundation — *NSF*[3,4,5] provided the information which included student achievement and perceptions, research information, results of national surveys, and observations of case study experts. When the results of Project Synthesis were available in 1981, it is fair to say that there was more information to consider in establishng a new focus and new purposes for science education than was ever before possible.

The Project Synthesis researchers concluded that the major problem in science education was its primary justification in the curriculum as preparation for further study. Each science offering included content because it would be needed for continuing study at the next academic level. And yet there is no evidence that the science content at any level is of any direct value to students in studying more science at the next level. Most teachers start anew with their course material, dismissing any earlier consideration of it as premature, justifying their actions because so few students demonstrate relevant knowledge or even acknowledge their previous study.

Justifying the study of science because it serves as preparation for further study is unfortunate when one considers the fact that most students will not continue to study indefinitely. In fact very few will study science beyond what they are required to complete for high school graduation. The *NSF* studies revealed that tenth grade biology is the last science course for over 80% af all graduates. Although half of all high school students continue to college, only half this number graduate four years later. And of those who graduate from college, fewer than two per cent from the original high school graduating class complete a major in one of the basic science disciplines or engineering. When one considers this of events, it can be argued that the school science experience, as preparation for more science study, is inappropriate for over 98% of the graduates from high school for any given year. If the completion of courses in high school is justified because of their need for further study and that alone, most students are not served well.

And yet the National Science Teachers Association *(NSTA)* has asserted the importance of science for all students every day of each year they are enrolled in school. The *NSTA* Board adopted such a manifesto unanimously in 1982. Further, the National Science Board *(NSB)* Commission in its 1983 report *Educating Americans for the 21st Century*[6] has identified the importance of science for all as one of two needs. Even though there have been pleas for science for all earlier, the calls today seem clearer, and from most prestigious sources; perhaps they are more likely to be heard.

But the second need for science education identified by the *NSB* Commission is the production of more and better scientists and engineers! These two »needs« for resolving today's problems in science education may be cause for alarm. The preparatory »need« is often first heeded. And, it is assumed that the typical rigorous high school program of biology, chemistry, physics (and/or advanced courses in these disciplines) is the best preparation for college and ultimately careers in science or engineering. However, most college scientists, rather than stressing exposure to their particular discipline of science in K-12 settings, describe the importance of mathematics, general study skills, curiosity, laboratory work, and introduction to other disciplines of science. And, interest and motivation in a particular area are generaly identified as desirable attributes.

At the same time significant introduction to a particular discipline is likely to result in such comments from college scientists as »too many erroneous concepts presented«, »inappropriate age level for developing real understanding«, and »secondary school science often results in superficial considerations«.

It is often assumed that early exposure to college-type courses will result in persons better prepared for college and more interested in advanced science/engineering programs. Yet a careful review[7,8,9,10,11,12,13,14] of the *NAEP*[1] results concerned with the affective domain suggests exactly the opposite. These studies indicate that typical school science programs discourage interest in science study and result in poorer understanding of the actual nature of science. In fact, the more school science a K-12 student takes, the less they like science or even find it useful. When viewing such results, one could argue that preventing students from studying science in school could be the best preparation for encouraging the pursuit of both science literacy and careers in the field. Students without formal training in science seem to have more attributes which are considered essential to »sciencing«.

The National Science Teachers Association in its position paper on Science for the 80's (again adopted unanimously by its Board of Directors) has asserted that the goal of science education during the 1980s is to develop scientifically literate individuals who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday decision-making. Such individuals both appreciate the value of science and technology in society and understand their limitations [15].

NSTA also adopted a list of attributes which describe a scientifically literate person. The school program might be established to assess the progress of an individual student on a continuum for each of these characteristics which define literacy. Such a consideration would enable teachers to measure their successes in helping students grow in »science literacy«. *NSTA* suggests a scientifically literate person:

- — uses science concepts, process skills, and values in making responsible everyday decisions;
- — understands how society influences science and technology as well as how science and technology influence society;
- — understands that society controls science and technology through the allocation of resources;
- — recognizes the limitation as well as the usefulness of science and technology in advancing human welfare;
- — knows the major concepts, hypotheses, and theories of science and is able to use them;
- — appreciates science and technology for the intellectual stimulus they provide;
- — understands that the generation of scientific knowledge depends upon the inquiry process and upon conceptual theories;
- — distinguishes between scientific evidence and personal opinion;
- — recognizes the origin of science and understands that scientific knowledge is tentative; and subject to change as evidence accumulates;
- — understands the applications of technology and the decisions entailed in the use of technology;
- — has sufficient knowledge and experience to appreciate the worthiness of research and technological development;
- — has a richer and more exciting view of the world as the result of science education; and
- — knows reliable sources of scientific and technological information and then uses these sources in the process of decision making.

Unfortunately, there is no evidence in any of the *NSF* Status Studies[3,4,5] to show that any existing science courses or programs contribute positively to the development of persons with such traits. One problem may be related to assessment instruments. Most measures of success are tied directly to the mastery of specific facts or concepts which are often unrelated to the characteristics of persons outlined above.

Another line of research of interest as new foci and purposes are sought is in the area of science »attentiveness«[16,17]. Science attentives are defined as persons who exibit interest in one area (in this case science/technology), demonstrate basic knowlegde, and can (on their own) pursue such interest and deepen knowledge. Although Miller et. al[16] and Voelker[17] do not use the term scientific literacy, such criteria as used to define science/technology attentives provide one operational definition of scientific literacy. When the three criteria for attentiveness are used for both science and technology, 90% of all high school graduates fail.

It is this knowledge that enables many to argue that we fail with at least 90% of the students with whom we deal in school science. But before taking comfort with success with 10% of our graduates, the Miller, et. al. — Voelker studies[16,17] need to be analyzed further. They point out that the 10% who are attentive to science/tecnhology achieve such condition in ways and means unrelated to school science. These studies suggest that parents and other non-school experiences (travels, community activities, television) are more important in producing attentives than is school science. In addition, students demonstrate more interest in and knowledge of technology than for science; and yet science is emphasized in school — too often to the complete exclusion of technology. Shockingly, the studies also reveal that the high school is ineffective in increasing student knowledge during the grade 9 to 12 period. This result is surprising when one considers the emphasis upon knowledge mastery in school science, mastery as demonstrated by recall and performannce on achievement measures. It is the mastery of such knowledge that is generally assumed to be important for those aspiring to further study of science in college.

Research in the area of cognitive science is another rich source of data for use in determining new foci and purposes for school science. Champagne and Klopfer[18] indicate that much of the science which is »learned« has no real meaning for large numbers of students. Even college students, including science majors, have been shown to have misconceptions of basic concepts of science. One needs to recall that these students are those who achieved at the highest levels on teacher tests and standard achievement measures in high school.

Students seem to learn best only from direct experiences. The misconeceptions they hold come from real world experiences; these experiences are the basis for their world view — the world as they have seen/experienced it. When this view is in conflict with the science of textbooks and school, students either reject the school science or play the school game. Those who reject the school/texbook science do poorly in school and are considered to be poor science students. Those who play the game do well on typical measures of success, although they often lack understanding thus retaining their experiences-based explanations. This explains the results of cognitive science research which indicated that many of the best science students have erroneous views of the universe. Unfortunately, sicence teaching/learning becomes dogma; it is a way of succeeding in the school community even though it defies understanding and real-world experiences. Champagne and Klopfer[18] state:

> *When we teach, we assume students interpret text, lectures, and experiments as we intended them to be interpreted. The evidence is accummulating that this assumption is not valid.*

Four goal clusters were basic to the Project Synthesis[1] research design. To be sure academic preparation was one of the four — the one commanding 98% of the attention in schools. The other three goal areas include: 1) science for meeting the personal needs of students, 2) science for resolving societal issues, and 3) science for awareness of careers related to science and technology. Although the goal clusters moy or my not be of equal importance, it is apparent that these other three should command more than 2% of our attention.

Harms[1] concludes his analysis of the Project Synthesis research indicating clearly the new focus and purpose needed: Can we shift our goals, programs and practices from the current overwhelming emphasis on academic preparation for science carrers for a few students to an emphasis on preparing all students to grapple successfully with science and technology in their own everyday lives as well as to participate knowledgeably in the important science-related decision our country will have to make in the future?

Voelker[17] is more specific in identifyng a new direction. He closes his review of the attentiveness studies in this way:

> *If we want a science program that is truly responsive and responsible to the citizen in a scientifically and technologically oriented society, we must elevate current and future citizen concerns. We cannot assume that curricula which emphasize traditional cognitive knowledge and an understanding of the scientific process will lead to an understanding of the science-related issues confronting society. Neither can we assume that such traditional curricula will assist our student-citizen in applying their scientific knowledge and processes to these issues.*

The evidence and logic both point to the importance of a new view of school science. Such a view suggests the use of current issues as organizers for units — perhaps whole courses. Hofstein and Yager[19] suggest putting students into positions of identifying real problems, seeking explanations, and devising tests for their explanations; actions basic to science itself. Further, with such foci students are no longer asked to first learn what the teacher knows — or what is in the texbook — and then (if there is time) to practice using it. Students begin with real problems where they see that they need knowledge in order to resolve issues or to act. Having the students see the need to know seems far better than the teacher and/or the system proclaiming that the students need to know. Most students do not see the need — and many who elect to play the game really do not »know«.

In many ways the science/technology/society (S/T/S) efforts seem to capture this new focus and purpose for school science. Such efforts are international — with some of the work in the United Kingdom the most noteworthy[20,21]. Some argue that the »'s« are reversed in the typical S/T/S usage; feeling that the starting point for school science should be society, a structural unit with which all persons can identify since they comprise it. Moving then to technology seems easy because it affects all people and all of society in general. Technology then can provide an entree to science — the basis for all technology.

Shamos[22] has argued that scientific literacy is a non-goal and that science for all may be an inappropriate goal. On the other hand, he suggests that technology may be appropriate since it is more concrete and closer to the lives of students. He argues that aspiring to a technological literacy for all students may be a more realistic goal than scientific literacy for all.

As this debate broadended the *NSB* Commission established an expert Task Force to consider the K-12 science program. After careful deliberation the Task Force endorsed a plan unanimously and offered it to the Commission for its report to the nation. The plan emphasized the importance of goal in areas other than academic preparation. Further, the plan provided a new focus for the content and new strategies for teachers to use.

The *NSB* Task Force on science curriculum recommended the following structure for school science[23]:

K-6. An integrated, hands-on approach is needed to focus on the relationships between humans and the total environment. Problem solving must be emphasized, including acquisition and analysis of data.

Grades 7-8. There should be two primary emphases: 1) on human science, including human biology and personal health; 2) on development of quantitative skills in science. Computer-based experiences should be used appropriately to assist in developing quantitative skills that will be needed for more complex, applied problem solving in grades 9-10. Skill in quantitative analysis of data, application of probability, and estimating skills are examples.

Grades 9-10. A two-year sequence, required for all students to address science, technology, and society. Emphasis should be on problem solving and scientific reasoning, applied to real-world problems. It should integrate knowledge and methods from physics, biology, earth science, and chemistry, as well as applied mathematics. The rationale for this sequence is that students need to have certain developmental tasks required in this course. It is a much higher level course than is generally recognized as »general science« for nonscience students.

Grades 11-12. One- and two-semester courses in physics, biology, chemistry, and earth sciences should be avaiable for students who wish to go on to further academic study in science-related courses. These are not advanced placement courses and should not replicate college-level courses. They build on and assume as prerequisites the skills and knowledge in the various science disciplines that students acquire in the science, technology, society course in grades 9-10. A third S/T/S course should be available and required for the non-college students.

The connecting links, the rationale, the objectives coincide exactly with the goal clusters of Project Synthesis. They provide an example of an S/T/S curriculum for schools.

To be sure a new focus and new purposes are needed. *NSTA's* searches for excellence are providing such vision. The yearly searches for examples of such vision provide rich description of new content and teaching approaches that exist in practite. The S/T/S exemplars provide descriptions of programs departing most from traditional high school offerings and programs responding most directly to the issues and problems identified by researchers. However, most *NSTA* Task Forces which have worked to define excellence from discipline perspectives are concerned with relevance, use in daily living, a special content appropriate for all learners. Apparently new purposes and new foci can be attained within the traditional sequence of courses which exist in most schools.

In summary, science programs which approach new purposes and provide a new focus seem to have the following common features:

1 A focus on social problems and issues. Science cannot be separated from the society which spawns it. It was a mistake trying to make science into an enterprise free of humans — free of societal issues — free of the real environment of life. For many, science has meaning only when it is presented in a real setting.

2 Practice with decision-making strategies. All persons must use information as evidence to reach decisions — decisions about daily living as well as decisions about the future of society. Without practice in using information for making decisions students are left with the feeling that the science they consider is unimportant and without use.

3 Concern for career awareness. If we live in a technological, scientific society, the careers related to science and technology are central to that society. A good science education for all must help with an awareness of such opportunities for

a lifetime of work. This does not mean a focus upon careers as only top rate scientists and engineers.

4 Local and community relevance. Science must be based in each community; it must have meaning for students in a given locale. Science study must be concerned with events and objects that can be seen, considered, and studied locally. Meaningful science cannot be just textbook science.

5 Applications of science central. Such applications/technologies cann be a means to a consideration of pure science. Technology has more relevance and is more easily seen and understood than the unifying ideas of pure science. Once motivated, once involved, once interested, students can be led to a consideration of deeper meanings and ideas. A consideration of basic science can be an outcome — a result — as opposed to a frontline goal or an organizational scheme.

6 Focus on cooperative work on real problems. Contrived exercises, individual work on verification activities, and textbook problems do not help students grow as cooperative citizens ready to tackle the societal problems of our time. A community concept is needed. A focus on problem identification and resolution rather than more problem solution is more realistic and a more desirable goal.

7 Emphasis upon multiple dimensions of science. For many students historical, philosophical, sociological dimensions of science may be more valuable than a content/discipline dimension. The process dimension is important, especially if it deals with practical situations such as decision-making. Surely the aplication,—i.e., technological dimensions, are more meaningful and viable for many. Political, economic, psychological, and creative dimensions are important views of science for others.

8 Evaluation based on ability to get and to use information. Nearly all evaluation in older models of science education focuses upon definition of terms and concepts and upon verification skills. Evaluation should be viewed as a part of the scientific continuum and hence basic to any study of science. Finding information and using it are two indispensable skills that must be practiced and valued in K-12 science education.

Perhaps it is long overdo that more creativity, more experimentation, more local relevance, more basic science, and more practice with using science learning in living be in evidence in school science. More than new requirements, new laws, and new pronouncements about the importance of science are needed before we can feel that we have moved toward an appropriate science for all learners. Proclaiming that science is so important that it should be required of every student every day of every year requires that new views of science be advanced. Such views are basic to the emerging S/T/S approach.

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POTREBNO: NOVO TEŽIŠTE I SVRHA OBRAZOVANJA IZ PRIRODNIH ZNANOSTI

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Obrazovanje iz prirodnih znanosti postalo je glavna briga rukovodilaca država, vođa i javnosti svijeta. U Sjedinjenim je Državama ta situacija dramatično drukčija od one prije pet godina. To razdoblje promjena potaklo je mnogo proučavanja, polemike, istraživanja i pisanja korisnih u prikazivanju potrebnih smjernica i korektiva na pomolu novog decenija.

Činjenice na koju upućuju pregledi uobičajene prakse, nacionalnih vrednovanja uspjeha učenika i njihova ponašanja, sinteza izvještaja koji požuruju reformu te etnografskih proučavanja upozoravaju na novo težište u školskoj nastavi prirodnih znanosti. Tome je pridonijelo iskustvo znanosti koje posebno uvažava pojedinca. Predlaže se program koji se gradi iz pojedinih problema i pitanja učenika, koji potiče znatiželju i izravno učenikovo sudjelovanje pri razmatranju akcija. Takvo uključivanje učenika zahtijeva temeljne informacije o znanosti. Novo težište naglašava sadržaj koji je potreban i koji se može koristiti nasuprot onome koji nastavnik i škola drži korisnim. Glavne točke novog programa bi bile:

1 Usmjerenje na društvene probleme i dileme, jer za mnoge znanost ima značenje samo u stvarnom kontekstu.
2 Praksa u strategiji donošenja odluka, i o dnevnom životu i o budućnosti društva, jer se bez toga učenika ostavlja s osjećajem da znanost koju upoznaje nije važna i da je beskorisna.
3 Briga za svijest o osobnom napredovanju u vezi sa znanošću i tehnikom, ali ne isključivo za vrhunske znanstvenike i inženjere.
4 Važnost za mjesto življenja i zajednicu, jer razumljiva znanost ne može biti samo udžbenička.
5 Primjena je znanosti u središtu pažnje, a razmatranje temeljnih znanosti nastupa kao rezultat interesa za tehniku, suprotno postavljenom vrhunskom cilju ili nekoj organizacijskoj shemi.
6 Usmjerenje prema zajedničkom radu na stvarnim problemima, uz koncept zajednice, s identifikacijom problema i njihovim razrješavanjem, a ne tek samo rješavanje zadanih knjiških problema.
7 Naglasak na višestrukosti znanosti, kao što su povijesni, filozofski i sociološki aspekti koji za mnoge učenike mogu biti značajniji od jednostranosti sadržaja dane discipline. Političke, ekonomske, psihološke i kreativne dimenzije mogu biti važnije drugima.
8 Vrednovanje zasnovano na sposobnosti da se dođe do informacije i da ju se iskoristi.

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Science/Technology/Society: The Current Focus for Achieving Useful Science

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To teach science as a review of what scientists currently know or as something students can use is an argument that has been waged for centuries. Aristotle in 300 B.C. captured the debate when he described the situation in the schools of ancient Athens (Hurd, 1969):

> There are doubts concerning the business of education since all people do not agree on those things which they would have a child taught, both with respect to improvement in virtue and a happy life; nor is it clear whether the object of it should be to improve the reasons or rectify the morals. From the present mode of education we cannot determine with certainty to which men incline, whether to instruct a child in which will be useful to him in life, or what tends to virtue, or what is excellent; for all these things have their separate defenders.

The debate was popularized in 1939 when J. A. Peddiwell's Saber-Toothed Curriculum was published. Is a subject taught because it is inherently good and the information offered will characterize an educated person? Or, is a subject taught because of its usefulness to the learner?

In the United States Thomas Jefferson, one of the leaders in establishing a new social order, argued strongly for an education that was useful. Reform movements through the years have invariably been arguments to move schooling to more useful experiences for the students enrolled. Teaching classical science has been the conservative approach, i.e. reviewing what is known in a given area with the assumption that this basic knowledge is needed before applications can be made and/or actions taken. "Reforms" have concentrated on putting science (and other curricular areas) in contexts which have been considered more meaningful and useful. Those debates continue as political leaders seek the information that every high school student should possess.

The one major time when this trend toward relevancy and usefulness was not in evidence was the 1957-75 period where the interest world-wide shifted to a focus on science for all as it is (was) known to scientists. These reforms of the 60s were the results of space exploits -- beginning in 1957 with the launching of the Soviet Sputnik. It is strange in retrospect that some of the most spectacular technological achievements prompted improved science education in schools which emphasized basic science and excluded technology (applications of science). The basic assumption was that science would be inherently interesting and appropriate for all if it were presented in a way that it is known to scientists. Much effort involving vast sums of money and many professional scientists was expended to define the unifying themes, basic concepts, major strands, the central structures of the various disciplines of science. Most projects also focused upon the skills possessed and practiced by the scientists who produced new knowledge and who conceptualized the basic structure of particular disciplines. Many of the curriculum developers called for an equal emphasis upon content and process.

As the 1980s emerged it was apparent world-wide that the fundamental assumptions of the efforts of the 60s were flawed. Science as it is known to scientists is not inherently interesting and it is not appropriate for all. Further, forcing all students enrolled in schools to learn such science was proving disastrous. Most left schooling in science with negative attitudes about science, science study, science teachers, and science courses. They could see little value in the science they had experienced and they could not use logic and other skills purported to be ingredients of science.

Ziman described the problems well in his (1980) book. He reviews course titles that have been used with various attempts to enlarge the domain of science as new courses and programs have been tried. Ziman developed a rationale (or offered a suggestion) for use of the term science/technology/society (S/T/S) as scholars across the world sought ways to define, describe, and model science programs that were more relevant and appropriate for students enrolled in elementary and secondary schools. Such programs were organized in ways other than some unique sequence of disciplines and some new ordering of topics characterizing a given discipline.

Some of the first national efforts to develop S/T/S materials occurred in the United Kingdom. John Lewis and colleagues in Malvern College developed a series of Science in Society modules. Later Joan Solomon (School of St. David and St. Katharine, London) developed Science in a Social Context (SisCon) as a second national effort with John Ziman as a major adviser. Workers in the United Kingdom continue to develop materials, to assess successes with teachers and schools, and to publish results of such efforts.

In the United States several S/T/S projects have emerged. They have often utilized the 1980 Position Statement of the National Science Teachers Association to justify their efforts. This statement proclaimed:

> The goal of science education during the 1980s is to develop scientifically literate individuals who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday decision-making. Such individuals both appreciate the value of science and technology in society and understand their limitations.

The National Science Foundation in the United States has funded several projects in the last few years to emphasize S/T/S materials and approaches.

One of the first was Rustum Roy's S-S/T/S Project at Pennsylvania State University. This project has established a national network for promoting S/T/S, a system for collecting and evaluating S/T/S materials, an annual national conference concerning technological literacy for all, and a module writing component.

Another major project at the University of Iowa has involved over 300 teachers in reorganizing their school programs around applications of science and technology with a focus on local relevancy. This project is an example of one where government, higher education, local schools, and industries are involved with developing and evaluating new instructional materials and teaching strategies. Science is becoming something to experience; it results in student actions; it is becoming central to the school program; it is visible in the community. Science for S/T/S teachers and students is not learning the material found in textbooks and further elaborated by teachers; it is no longer a matter of information acquisition; it is no longer information alien to living. Instead, science comes from a student and teacher problem that can be analyzed and studied. Possible actions/solutions are considered and perhaps tried. Experiences with actions and information needed to resolve issues is considered basic to learning.

S/T/S programs have many features in common. One of the most important is the identification of problems and questions -- real ones for the students. It is not starting with an outline of information to be examined and mastered with the rationale that first one "needs to know certain information" before real questions (ones researchers raise) can be formulated or before students can be engaged in meaningful activities.

Interestingly Einstein has emphasized the importance of questions in the pursuit of science. He said:

> the formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advances in science.

Perhaps focusing on student questions is a better starting point for real science than is the presentation of information and the testing for recall of it.

By definition S/T/S approaches must be local -- at least to the point of direct student involvement. Obviously this can and should include problems that are national or world-wide. However, the primary focus for S/T/S is personal involvement. It is an individual and his/her relationship to a social order -- the family, the school, the community. Some have argued that Ziman has inverted the two S's in S/T/S -- that the first one should be "society" which is an entity that all students (and all people) can feel a part.

For many, technology is the connector in S/T/S efforts; it is the entree for many to the world of science. Technology -- the applications of science -- is concrete and something that affects all. Modern technology separates nations and cultures; it too often separates the haves from the have-nots. Technology is basic to modern nutrition, to clothing, to buildings, to transportation, and to communication. Certainly technology is related to science and for most the only understandable and important facet. However, a skillful teacher can use the power (and concerns) of technology as a means of moving more students to science. Students often become curious about technology -- the how, why, what if questions. Often basic science information is needed to satisfy their curiosities. What a shift -- to have students requesting knowledge because it is useful/needed instead of because the teacher insists it will be useful or because it is in the textbook/course outline.

The S/T/S movement is an international one. Four Symposia on World

Trends in Science and Technology Education have been held, with the last in West Germany in 1987. Scientists and educators from all over the world seem anxious to gather to discuss issues, to share experiences, and to develop plans for moving to even more exciting programs designed to improve society and to provide a more meaningful science education for all.

Some of the definitive features of S/T/S programs include the following:

1) identification of problem with local interest/impact;

2) use of local resources (human and material) to locate information that can be used in problem resolution;

3) active involvement of students in seeking information that can be used;

4) science teaching going beyond a given series of class sessions, a given meeting room, or a given educational structure;

5) a focus upon personal impact -- perhaps starting with student curiosity and concern -- not merely hoping to get to that level;

6) a view that science content is not something that merely exists for student mastery simply because it is recorded in print;

7) a de-emphasis upon process skills -- just because they represent glamorized skills of practicing scientists;

8) a focus upon career awareness -- especially careers that students might expect to pursue as they relate to science and technology and not merely those related to scientific research, medicine, and engineering;

9) students performing in citizenship roles as they attempt to resolve issues they have identified;

10) science study being visible in a given institution and in a specific community;

11) science being an experience students are encouraged to have;

12) science with a focus upon the future and what it may be like.

McCormack and Yager (in press) have identified five domains for science education. These domains include: connections and applications, attitudinal, creativity, process, and information. For S/T/S instruction this ordering of the domains is important. It is necessary to begin with a problem that students identify and internalize. This focus invariably improves attitude, and it encourages creativity. These two domains make it possible for most to enter the process and information domains--which are the starting points for traditional science teaching.

Figure 1 is an attempt to illustrate the domains of science and their applicability in visualizing S/T/S. Students from society at large identify problems related to their lives. Almost invariably current problems are related to science and technology. Technology, particularly, affects all lives most directly, including homes, clothing, transportation, communication, careers, leisure activities, food, health. Technology was separated from science study during the 60s; new technology has become central--the means of connecting people to the world of science. Dealing with and understanding technology provides opportunity for enhancing interests of students and their creative skills with dealing with them. In some respects creativity and attitude are like the dynamic membrane of a living cell--regulating and/or affecting what gets into and out of the system. Creativity and attitudes become more negative as a result of typical science instruction. The situation is reversed when science is experienced in the S/T/S format.

S/T/S ideas and approaches have been introduced in classrooms of 300 teachers in grades 4 through 9 in Iowa. Assessment of results have been central to the effort which has been supported by the National Science Teachers

Association, the Iowa Utility Association, and the University of Iowa. Some of the emerging results demonstrate the advantages of an S/T/S focus for school science.

Students are better able to apply information, to relate information to other situations, to act independently, and to make decisions. 13 and 14 year old students were tested over a three year period in specific schools where a class had experienced science in a traditional manner and one class an S/T/S focus. General areas of contrast indicate the following differences:

	Percent students after traditional class	Percent students after S/T/S class
Demonstrate the use of information in new setting	25	81
Ability to relate two phenomenon in new situation	18	66
Identify related but divergent questions from a given situation	17	83
Ability to choose relevant information for solving a problem	26	91
Ability to act based on new information provided	35	89

Utilizing some of the affective items from the Science Assessment of the National Assessment of Educational Progress provides a means for contrasting student attitudes after experiencing science in a traditional classroom vs. one focussing on S/T/S. Reports from several thousand students contrast the situation:

Student Perception	Percent Students Enrolled in Randomly Selected School	Percent Students Enrolled in Schools with S/T/S Science Program
Science classes are fun	40	81

Science classes are boring	31	14
Science classes make me curious	24	71
Science classes help me make decisions	31	63
Science teachers like my questions	48	88
Science teachers admit to not knowing	22	74
Information from science classes is useful	69	81
Science is a favorite course	11	22
Science is least favorite	19	6

There are many facets of creativity and many instruments that have been developed to assess in this domain. One aspect that has received attention in Iowa is concerned with questioning. Some of the differences in abilities of 13 and 14 year olds following traditional science instruction and S/T/S instruction include:

	Average Number in 30 Traditional Classes	Average Number in 30 S/T/S Classes
Number of questions generated after same situation is presented	580	1160
Number with unique questions (less than 10% with similar ones in given class sample)	21	105
Number who can distinguish between cause and effect	216	643
Ability to offer unique explanations	51	342
Suggestions of unique tests of ideas	28	405

Process has been a dimension of science which has received major attention in science education for nearly 40 years. Unfortunately, most of the attention has been lip-service with little research evidence to demonstrate that science teaching resulted in students who possessed better science process skills than they had without instruction. Again, S/T/S efforts have produced students better able to perform basic science processes. Following is information that demonstrates the contrast for 13 and 14 year old students in 30 class groups:

	Percent demonstrating ability from 30 traditional classes	Percent demonstrating ability from 30 S/T/S classes
Selecting best experimental procedure	24	52
Hypothesizing	18	63
Composing & differentiating	31	84
Measuring	33	91
Using numbers	40	89
Predicting	19	71
Drawing conclusions	24	82

Acquisition of information has been a primary focus for school sciences. Some have feared that an S/T/S approach would result in less information. The following listing demonstrates that such a fear is not well-founded with respect to 8 concepts studied in 30 schools involving 850 9, 13, and 17 year old students:

Percentage of Students Able to Select Most Accurate Definitions
for Eight Basic Science Concepts

	Nine Year Olds		Thirteen Year Olds		Seventeen Year Olds	
	Random	**S/T/S**	**Random**	**S/T/S**	**Random**	**S/T/S**
Volume	29	12	75	65	57	71
Organism	66	43	67	71	61	84

Motion	41	14	65	62	66	89
Energy	40	29	54	45	39	64
Molecule	25	29	54	48	53	68
Cell	15	17	46	43	44	42
Enzyme	23	19	24	31	21	52
Fossil	36	29	54	48	48	71

Information concerning student retention over time has not been collected. Some of the S/T/S efforts have been too new to permit follow-up studies over the span of several years. However, since S/T/S students are so much better at making applications and connecting experiences to others, there is every indication that the information students possess is indeed knowledge, i.e. information that is useful. If information which is mastered can be used and if it has real meaning for the learner, there is every reason to believe that S/T/S instruction is providing a much better experience in the information domain. The S/T/S effort with 300 teachers in Iowa has provided specific results with the students they have touched that demonstrate the power of S/T/S as a primary focus for science teaching/learning.

There is nothing magical about Ziman's suggestion that the term S/T/S be used in connection with current efforts to provide a more meaningful science experience for all people. It does provide a useful label -- and one that has generated much attention and excitement. And yet that can be a problem as well! Some are already arguing that S/T/S is just the latest fad -- that it is an attempt to deemphasize basic science -- that it can not succeed unless teachers and students first have some "basics". This is the major reason for putting such current reform efforts into an historical context. Are we not debating the issue described by Aristotle? What is appropriate school science for all -- that which can be used or that which presents the basic discipline structures visualized by science practitioners? Is science which focuses upon experiences and ideas that students can use in their daily existence, that they can use in dealing with current societal issues, or that can be used in making career choices different from the science that is often found in course outlines and textbooks? Can traditional science be useful for most without some help, guidance, and practice with such use? Science education for all implies that it must be useful for all. And, this usefulness must be apparent to the learner and must be an actuality--not merely a promise.

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APPENDIX VIII

OTHER MANUSCRIPTS WHICH RELATE TO STS EFFORT IN IOWA

ASSESSING TEACHING/LEARNING SUCCESSES IN MULTIPLE DOMAINS OF SCIENCE AND SCIENCE EDUCATION

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There are many valid ways of viewing science and science education. Unfortunately a major problem seems to exist when science is viewed and when it is taught as a body of knowledge. Some, to justify a focus on knowledge, maintain that no dimensions can be viewed and understood without prior knowledge. Certainly this is true in one sense; however, this situation need not translate into "you must first know what I know--then you can consider other dimensions and move into other domains." And yet, this is what invariably seems to happen in schools and in undergraduate science education.

It is impossible to imagine any human without some prior knowledge--knowledge that is useful in considering science from a variety of perspectives. And, it is difficult to accept that real learning can occur in isolation of the real world and direct experience. The diversity of learners suggest that there is a real issue concerning the degree of understanding which is possible, and which is appropriate for various people. Can teachers share experiences with their students and make these "student" experiences? Is it necessary for students to know the teacher's vocabulary and basic knowledge in order to operate?? Much current research indicates that these questions must be answered with resounding "no's"!

For persons active in current efforts in science education, often called science/technology/society (S/T/S), such problems are not an issue. S/T/S approaches mean focusing upon issues, controversies, non-conformities, points of curiosity. S/T/S means exploring and formulating problems and sub-problems while collecting information directly. Since the students will be exploring and identifying questions, the studies will be related to the real world of the student. S/T/S shows students the power and value of knowledge since students need knowledge in order to operate. Knowledge is not something given by teachers with a promise that it will be useful.

S/T/S programs begin at the application/connections domain. Everything considered--all information that is sought--all actions taken--all evidence gathered--is student assembled and used by students by definition, gaining application and connections. The application/connections domain seems to be a desired starting point if one is concerned with providing an appropriate and meaningful experience with science for all.

Rather than to assume that one may be able to reach the application/connections domain after experiences with organized knowledge and some processes (skills) used by scientists, start with applications, real issues, relevant questions, ideas that provide linkages and connections for students. Such a starting point offer "higher-order thinking skills" in a context of a problem rather than as a separate entity in the school program. Such starting points also emphasize the real world where science is not something people do in science classes or laboratories. Science is seen related to everything, especially curriculum areas such as mathematics, social science, and the humanities.

Apparently it is not necessary to study new knowledge and to experience new process skills out of any real life context before becoming involved with a problem/issue that provides for applications and connections for learners. In fact, it seems that knowledge and process may be derived from the experiences provided by a problem situation. How did Mendel learn of genetics? Students can apply and connect without knowledge and process. On the other hand, is it possible for a student to demonstrate knowledge and process without the ability to use either? And, is it possible for real learning to occur if it cannot be used? Is it possible to have valid knowledge of science and technology that is not (cannot be) used?

Too often tests are prepared assuming the importance of having some items at all levels (on Bloom's taxonomy). However, invariably there is a disbalance--in favor of the fact level. And, of course, both teachers and students always find such items easier to create and answer. They may indeed be easier because of the preponderance of time and effort spent teaching for the acquisition of factual knowledge--usually for its own sake.

Standardized achievement tests emphasize knowledge--often only vocabulary. Skills are usually included--often requiring mathematics--but rarely in excess of the knowledge type items. Recent analysis of the NSTA-ACS Chemistry Achievement Examination, the BSCS Comprehensive Final, and the NSTA-AAPT Physics Achievement Examination have identified few items that cannot be classified as knowledge or skill. And, the items are unrelated to the stated goals of professional societies, curriculum innovators, the authors of leading textbooks. Interestingly, college scientists rarely identify any of the material from these achievement tests as essential attributes for incoming students.

Knowledge and process are both enhanced if students have positive attitudes and if they are creative. Creativity and favorable attitudes can be improved. However, most traditional science programs discourage creativity and result in negative student attitudes (Yager and Penick, 1986). Instead of concentrating on instructional techniques and situations that enhance student creative thinking and positive attitudes, a focus on knowledge acquisition (and to a lesser degree the skills scientists use) proves detrimental to growth in both domains. Most science teachers to not measure for growth in these domains and are content that they represent a softness and concern that are really not all that important to their students.

If a focus on knowledge per se (with passing lip service to processes scientists use to produce knowledge) turn most people off, it is small wonder that most science courses cause students to decrease in creative thinking and to develop more negative attitudes about science. Students also report that typical courses lessen curiosity, excitement, ability to create explanations, ability to reason and to make critical decisions based on evidence.

The National Assessment of Educational Progress has included items from the affective domain in each of the last three Assessments of Science. Generally the results with these items substantiate that student attitudes are poor regarding their perceptions of science classes and science teachers. Nonetheless, the National Assessment has provided instruments which are generally available and norms have been established. And we now know that exemplary science programs and exemplary science teachers produce extremely positive student results in this domain (Kirkpatrick and Yager, 1986; Simmons and Yager, 1986).

The National Assessment has also included some items in the Application and Connections Domain. Again, the results for students enrolled in random schools are not very positive. After all, it is rare to find science programs and teachers that provide experience in this domain--one that should be the starting point for all students if they are to see the value of science and if they are to reach a point of motivation, curiosity, and creative problem solving. And, when they develop adequately in this domain, they are ready for knowledge and process; they see the value and need; many more students demand explanations and skills to answer their questions, to satisfy their curiosities. This is the power of an S/T/S approach to school science.

Figure 1 is an attempt to demonstrate a connection among these five domains of science and science education. The figure illustrates the logic of starting with the real world, the world of application and connections as a pathway to important and valuable facets of science knowledge and processes. To start in the core and to move to the application/connection domain is difficult for many and "abnormal" for most. Such an emphasis encourages most students to differentiate between real world science (based on personal experiences) and school science (based on the information included in textbooks and course outlines). Most would agree that the goal for all students is to move among the domains; everyone expects students to apply and to connect. However, little instruction is concentrated in this domain, the major difference between S/T/S and typical science instruction.

Following is an elaboration of the various components of the five domains. Each of these can help in terms of planning instruction and evaluation for school science.

Domains of Science Teaching

Domain I - Knowing and Understanding (knowledge domain)

Science aims to categorize the observable universe into manageable units for study and to describe physical and biological relationships. Ultimately, science aims to provide reasonable explanations for observed relationships. Part of any science instruction always involves learning by students to some of the information developed through science.

The Knowing and Understanding Domain includes:

Facts

Information

Laws (Principles)

Existing explanations and theories being used by scientists

Internalized knowledge which can be used

All of this vast amount of information is usually classified into such manageable topics as: matter, energy, motion, animal behavior, plant development.

Domain II - Exploring and Discovering (process of science domain)

How scientists think and work provides another dimension of science. There are specific and definable processes that characterize human actions that result in new knowledge of the universe. Generally these processes are embodied in the terms "exploring and discovering." Some processes of science which can be used in science instruction illustrate goals/outcomes in this domain:

Observing and describing

Classifying and organizing

Measuring and charting

Communicating and understanding communications of others

Predicting and inferring

Hypothesizing

Testing

Identifying and controlling variables

Interpreting data

Constructing instruments, simple devices, and physical models

Domain III - Imagining and Creating (creativity domain)

Most science programs view a science program as something to be done to students to help them learn a given body of information. Little formal attention has been given in science programs to development of students' imagination and creative thinking. Here are some of the human abilities important in this domain:

Visualizing - producing mental images

Combining objects and ideas in new ways

Producing alternate or unusual uses for objects

Solving problems and puzzles

Fantasizing

Pretending

Dreaming

Designing devices and machines

Producing unusual ideas

Identifying

Isolating

Merging

Diverging

Converging

Much research and development has been done on developing students' abilities in this creative domain, but little of this has been purposely incorporated into science programs.

Domain IV - Feeling and Valuing (attitudinal domain)

In these times of increasingly complex social and political institutions, environmental and energy problems, and general worry about the future, scientific content, processes, and even attention to imagination are not sufficient parameters for a science program. Human feelings, values, and decision-making skills need to be addressed. This domain includes:

Developing positive attitudes toward science in general, science in school, and science teachers

Developing positive attitudes toward oneself (an "I can do it" attitude)

Exploring human emotions

Developing sensitivity to, and respect for, the feelings of other people

Expressing personal feelings in a constructive way

Making decisions about personal values

Making decisions about social and environmental issues

Exploring arguments on either side of an issue

Domain V - *Using and Applying* (applications and connections domain)

It seems pointless to have any science program if the program does not include some substantial amount of information, skills, and attitudes that can be transferred and used in students' everyday lives. Also, it seems inappropriate to divorce "pure" or "academic" science from technology. Students need to become sensitized to those experiences they encounter which reflect ideas they have learned in school science. Some dimensions of this domain are:

Seeing instances of scientific concepts in everyday life experiences

Applying learned science concepts and skills to everyday technological problems

Understanding scientific and technological principles involved in household technological devices

Using scientific processes in solving problems that occur in everyday life

Understanding and *evaluating* mass media reports of scientific developments

Making decisions related to personal health, nutrition, and life style based on knowledge of scientific concepts rather than on "hear-say" or emotions

Integrating science with other subjects

Taking specific actions designed to resolve problems and/or to improve a local, regional, national, and/or international problem

Becoming involved in community-action projects; extending school experiences beyond the classroom

Emphasizing the interrelationships and interconnectedness of science to other human enterprises

More and more teachers and school leaders are moving to assessment of student growth across multiple grade levels and in all domains. This kind of assessment is particularly important for schools moving to the S/T/S focus. More and more parents, political leaders, administrators, and interested members of communities are becoming familiar with various measurements and various ways of determining successful science programs. Can we really be successful without attention to all five domains?

Some common instruments in each domain are outlined below. Many are inappropriate for all grade levels and in their complete format. However, a review of such instruments is important as we move toward more meaningful science experiences and measurement growth in all five domains.

Domain I - *Knowing and Understanding* (knowledge domain)

1) *Science Subtest, Iowa Tests of Basic Skills* (Hieronymus, et al)
2) *Science Subtests, Iowa Tests of Educational Development* (Feldt, et al)

3) Science Subtest, Metropolitan Achievement Tests (Prescott)

4) Stanford Achievement Test (Madden, et al)

5) ACS/NSTA Cooperative Chemistry Test (ACS-NSTA)

6) Physics Achievement Examination (AAPT-NSTA)

7) Biology Comprehensive Final (BSCS)

Domain II - Exploring and Discovering (process of science domain)

1) The Methods and Procedures of Science: An Examination (Woodburn)

2) Test of Enquiry Skills (Fraser)

3) Wisconsin Inventory of Science Processes (Welch)

4) Cedar Rapids Schools Science Process Measure (Phillips)

5) Scientific Curiosity Inventory (Campbell)

Domain III - Imagining and Creating (creativity domain)

1) Purdue Creativity Test (Lawshe, et al)

2) Torrance Tests of Creative Thinking (Torrance)

3) Modes of Thinking in Young Children (Wallach, et al)

4) How Do You Really Feel About Yourself (Williams)

Domain IV - Feeling and Valuing (attitudinal domain)

1) Student Preferences and Understandings (NAEP)

2) Scientific Attitude Scale (Moore and Sutman)

3) Attitude Toward Study of Science (Yager)

4) Test of Attitudes on Technology-Society Interaction - (Piel)

5) Attitudes Toward Science and Technology (Temple University)

6) Test of Science-Related Attitudes (Fraser)

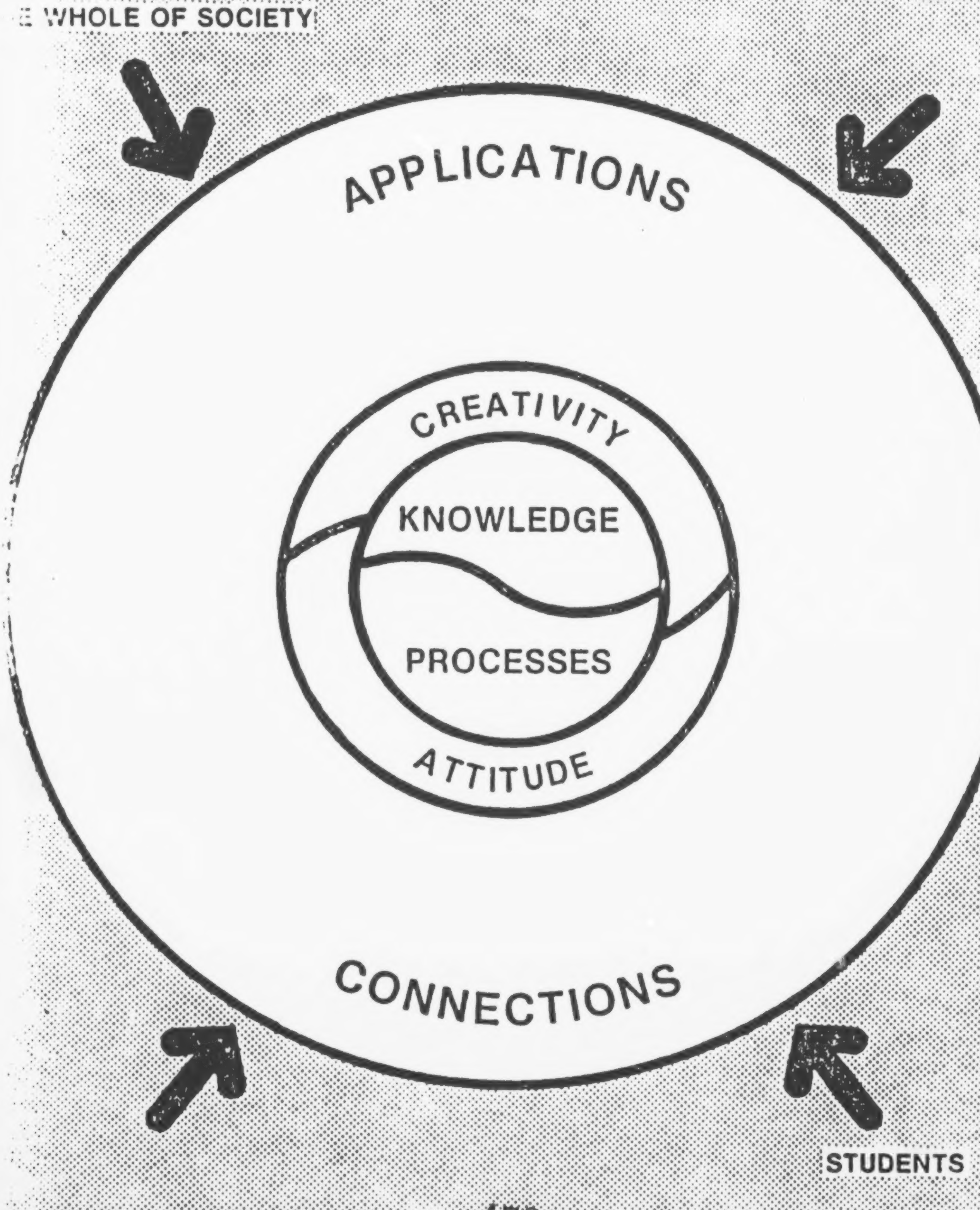
Domain V - Using and Applying (applications and connections domain)

1) Science and Society (Dagher)

2) Views on Science-Technology-Society (Aikenhead)

3) Test on the Social Aspects of Science (Korth)

4) STS Examination Items for Science in a Social Context (ASE)


WHOLE OF SOCIETY
APPLICATIONS
CREATIVITY
KNOWLEDGE
PROCESSES
ATTITUDE
CONNECTIONS
STUDENTS

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THE IMPORTANCE OF TEACHERS IN STUDENT SELECTION OF FAVORITE AND LEAST FAVORITE COURSES

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THE IMPORTANCE OF TEACHERS IN STUDENT SELECTION OF FAVORITE AND LEAST FAVORITE COURSES

The National Assessment of Educational Progress (NAEP) included numerous items in the affective domain with the Third Assessment of Science conducted in 1977 (NAEP, 1978). One aspect of this assessment was student opinion concerning favorite and least favorite courses. Several follow-up studies have been conducted following the release of the NAEP items in 1978. One of these focused on student interest at National Science Teachers Association (NSTA) Exemplary Science Centers as opposed to the situation found in schools in general (Simmons, P. E., & Yager, R. E., 1987 and Yager, R. E., Simmons, P. E., & Penick, J. E., 1987).

From the exemplary - general comparison, this study was extended to include a small rural school in Illinois where the authors secured permission to conduct a follow-up of the NAEP affective items involving the total school population in grades three, seven, and eleven. This total population included 52 nine year olds, 47 thirteen year olds, and 54 seventeen year olds. Of great interest was the middle/junior high teacher who had been targeted as a problem. In fact, the administrators were seeking specific information that could be used for dismissal; perhaps this was one reason for the cooperation that was given for completing the study.

The NAEP follow-up instrument (Preferences and Understanding Assessment, 1984) was administered to all students in the spring nearing the end of the school year so students were able to reflect upon their experience with their science class and teacher for the year that was nearing an end.

Tables I, II, and III display the results of the survey. Information reported by NAEP and information obtained from a study of one of the NSTA exemplary centers is included to permit easy comparison.

Tables I and II offer interesting data regarding science as a favorite (or second favorite) course. In the elementary school, science is more popular than in schools selected at random--but considerably less popular then the situation found in a school recognized for its exemplary science program. Student interest in science, is maintained in the exemplary program across all grade levels and goes up slightly in random schools, not really changing between seventh and eleventh grade. However, in the small rural school there is not a single student who selects science as a favorite subject among thirteen year olds. And, this lack of interest is not reversed by the eleventh grade where only two students select science as a favorite course.

Table III reports the converse situation. Relatively few persons in the schools with exemplary science programs select science as the least favorite subject, even though eleventh grade students are more likely than thirteen year olds to name science as their least favorite, the number is still half who report science as least favorite in schools in general. In the rural Illinois school, 36% of the seventh grade students select science as the least favorite subject. Fewer of the eleventh grade students select science as least favorite--a figure very close to the percentage found in random schools.

Perhaps the success of science programs should include such data from students. To have so many students who dislike science in the junior high school and so few who select science as a favorite subject raises many questions. Knowing the perceived problems with the rural junior high science program makes it tempting to relate the negative student attitudes to the quality of teaching and teacher. It is certainly frightening to see what an unmotivated and unsuccessful teacher can do to student perceptions about studying science further.

At the same time, it is gratifying to see the relationship between exemplary science programs and the popularity of studying science. While the teacher may have a negative impact, the power of the teacher in affecting these same attitudes is undeniable. Good programs and good teachers result in more students who learn and who want to study in greater depth for more time. As we have always known, teachers do make a difference--let's see that it's a positive difference.

Table I

PERCENTAGE OF STUDENTS IDENTIFYING THEIR FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds			Thirteen Year Olds			Seventeen Year Olds		
	A	B	C	A	B	C	A	B	C
Language Arts	24	4	4	15	5	0	16	15	15
Social Studies	3	2	0	13	5	15	13	14	6
Mathematics	48	24	27	30	16	23	18	18	21
Science	6	24	12	11	22	0	12	23	2

A - All Schools - from 2500 students included in deep stratified, random samples selected by NAEP (1978)

B - Exemplary Program Schools - from 630 students from schools with multiple exemplary science programs (Jefferson County, Colorado, 1986)

C - Rural Illinois School - from 153 students representing total school population, including 52 nine year olds, 47 thirteen year olds, and 54 seventeen year olds

Table II

PERCENTAGE OF STUDENTS IDENTIFYING THEIR SECOND FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds			Thirteen Year Olds			Seventeen Year Olds		
	A	B	C	A	B	C	A	B	C
Language Arts	24	9	13	18	11	7	17	11	13
Social Studies	4	0	6	14	5	17	11	20	11
Mathematics	20	14	13	19	18	26	13	20	26
Science	8	24	12	18	22	2	14	17	19

A - All Schools - from 2500 students included in deep stratified, random samples selected by NAEP (1978)

B - Exemplary Program Schools - from 630 students from schools with multiple exemplary science programs (Jefferson County, Colorado 1986)

C - Rural Illinois School - from 153 students representing total school population, including 52 nine year olds, 47 thirteen year olds, and 54 seventeen year olds.

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Table III

PERCENTAGE OF STUDENTS IDENTIFYING THEIR LEAST FAVORITE COURSES ACROSS GRADE LEVELS

	Nine Year Olds			Thirteen Year Olds			Seventeen Year Olds		
	A	B	C	A	B	C	A	B	C
Language Arts	22	19	21	28	22	32	31	30	28
Social Studies	3	0	17	12	38	0	21	14	33
Mathematics	18	19	23	27	22	15	31	17	19
Science	11	2	6	19	6	36	30	16	29

A - All Schools - from 2500 students included in deep stratified, random samples selected by NAEP (1978)

B - Exemplary Program Schools - from 630 students from schools with multiple exemplary science programs (Jefferson County, Colorado, 1986)

C - Rural Illinois School - from 153 students representing total school population, including 52 nine year olds, 47 thirteen year olds, and 54 seventeen year olds

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MEASURING IN THE PROCESS DOMAIN

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MEASURING IN THE PROCESS DOMAIN

Paul Hurd has cast doubts on the appropriateness of a focus on process skills, as a teaching emphasis or an area for concern in formulating objectives for school science. He said:

> "The development of Enquiry skills as a major goal of instruction in biology appears to have had only a minimal effect on secondary school teaching. The rhetoric about enquiry and process teaching greatly exceeds both the research on the subject and the classroom practice. The validity of the enquiry goal itself could profit from more scholarly interchange and confrontation even if it is simply to recognize that science is not totally confined to logical processes and data-gathering."

Hurd's observation followed the work of Project Synthesis (Harms & Yager, 1981), where inquiry was one of the five focus groups. Project Synthesis included a proactive synthesis of what an ideal program would be like and a retroactive synthesis about what was occurring in schools. The difference between the two conditions was so great that some called for the elimination of inquiry as a focus area for the study; it was too elusive; there was too little evidence that anything had been done or could be done.

Fortunately, NSTA's Search for Excellence in Science Education (SESE) included the Desired State criteria in its first search for exemplary programs in 1982. Ten programs were identified where more exciting features were revealed. Unfortunately, however, the majority of these programs focused upon scientific investigation and involved the most gifted students. And, there was little evidence that students who experienced such programs possessed more and/or better process skills.

Process skills are those behaviors that scientists use in doing science. During the 60s the American Association for the Advancement of Science--with support from NSF--developed a whole elementary science program called Science--a Process Approach (SAPA). A total of 13 processes were identified and used as the framework for learning activities and course structure. These include measuring; observing; communicating; using numbers; interpreting data; defining operationally; using time/space relationships; classifying; experimenting; formulating hypotheses; inferring; predicting; controlling variables. Few studies have been conducted to show student growth in terms of attainment and/or improvement of these processes across grade levels.

Binadja has categorized process skills into eleven general skills. These include: using time/space relationships; design of experimental procedures; measuring and charting; defining operationally; formulating hypothesis; classification/grouping; using numbers; controlling variables; hypothesis testing; communication with others; inferring. This classification scheme has been used to develop assessment items for use in middle and junior high schools (grades 4 through 9). The instrument was developed and piloted in the NSTA-sponsored Chautauqua project in Iowa.

During the 1986-87 academic year, five teachers administered two versions of the test to approximately 60 students at each of six grade levels. It was possible to determine differences in ability across grade levels with the processes studied (with the sample items developed). During the fall of 1987 it has been shown that students can improve with respect to process skills as a result of S/T/S instruction.

The following listing of correct responses on the eleven item instrument illustrates that such skills do increase over grade levels:

4th	4.0	7th	5.4
5th	4.4	8th	5.8
6th	5.0	9th	6.2

Nonetheless, the time required for test administration and reading levels resulted in reassessment of the testing strategy. Two versions of the instrument--one for grades 4-6 and one for grades 7-9 were developed for use during the 1987-88 academic year in the Iowa Chautauqua program.

Pilot use of these two instruments during the fall caused some concern for difficulty. Some of the items proposed for use with grade 4-6 students proved more difficult than the one for 7-9. Nonetheless, pilot studies with the instrument have shown that students can develop more skills and/or become more proficient with others as a result of instruction. These new data seem to refute Hurd's analysis of the focus on and research into science processes. Table 1 provides the results of this effort.

Table 1

Average scores for students enrolled in classes taught by six lead science teachers in Iowa

Grade	# of students	Initial scores	Scores after 2 months of instruction
4	61	3.8	4.6
5	55	4.1	5.7
6	53	4.5	6.0
7	72	5.1	6.2
8	81	5.6	6.7
9	69	5.8	7.1

The special instruction included daily attention to one of the eleven process skills included in Binadja's taxonomy. Most teachers developed learning activities that were suggested by the assessment instruments. In no case, however, were the same situations or the test itself used as an instructional tool. Many teachers reported that the special activities that were designed for use over a three-week period were popular with students. Several continue with such activities as a part of their regular teaching repertoire. In these instances it will be interesting to follow the students with respect to even more growth in the process domain.

Of course the teachers that were involved were special teachers. All had been involved as lead teachers in the Iowa Chautauqua program. Also, the S/T/S focus invites teacher and student attention to process skills. Nonetheless, it is now apparent that teachers must devote instructional time to the development of specific process skills. And, teacher concern and assessment in this domain stimulates student attention, concern, and growth.

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COMPARISON OF STUDENT ATTITUDES ABOUT SCHOOL SCIENCE IN A DISTRICT WITH MULTIPLE EXEMPLARY PROGRAMS WITH THOSE FOUND GENERALLY

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COMPARISON OF STUDENT ATTITUDES ABOUT SCHOOL SCIENCE IN A DISTRICT WITH MULTIPLE EXEMPLARY PROGRAMS WITH THOSE FOUND GENERALLY

Interest in the affective domain with respect to school science has become more intense since the 1978 Third Assessment of Science as a part of the National Assessment of Educational Progress. Norris Harms, the architect of the extensive sets of affective items, was able to utilize this information in Project Synthesis, the NSF research effort which established some new directions in science education for the 80s (Harms & Yager, 1981). Many of the same affective items were used for the Fourth Assessment of Science, a special research project funded by NSF to be added to the planned assessment in mathematics by the National Assessment of Educational Progress. This Fourth Assessment, headed by Wayne Welch, provided a needed comparison of student achievement in science and attitudes about science between 1978 and 1982 (Hueftle, Rakow, & Welch, 1983). A Fifth Assessment of Science from the National Assessment of Educational Progress, now administered by the Educational Testing Service at Princeton, has been completed with results to be released during the next year; again items in the affective domain are included.

Several follow-up studies in the affective domain have been conducted at the Science Education Center, The University of Iowa. These studies have focused primarily upon the items which allowed a cross level comparison of nine year olds, thirteen year olds, seventeen year olds, and young adults (Yager & Penick, 1984, 1986; Yager, 1982; Yager, 1983; Yager, Yager & Bonnstetter, 1984; Yager and Bonnstetter, 1984). For the Iowa follow-up efforts students were selected at the third, seventh, eleventh grade levels and young adults working in the same community between ages 25 and 35. The Iowa studies between 1980 and 1985 focused upon general samples of students identified by science supervisors and/or departmental chairs involved in leadership programs. The attempt was to establish the extent of the rather negative impact of experiences with school science in terms of student attitudes concerning their science classes, their science teachers, and the perceived value of their science classes. The last report of these studies which included the adult sample (the most difficult information to collect) appeared in 1986 (Yager & Penick).

As the results of these studies appeared, many teachers and other professionals felt depressed and at a loss to explain such negative trends with respect to attitude and experience with typical school science. In fact, many countered that such results were "normal", i.e., an expression of natural growth and development. Apparently students merely became more negative as a part of maturation. Few found such studies as a reason for trying new and different approaches.

In order to test the validity of such arguments the present study was conceived. For the past four years the National Science Teachers Association has conducted annual searches for exemplary programs across the entire nation. All of the initial searches (and to some degree all others that followed) used the Desired-state conditions that were produced as one type of product of the NSF research effort called Project Synthesis (Harms & Yager, 1981). Various futuristic reports, the results of study commissions, a look at the latest research and philosophy in the various disciplines of science, and the charges of a variety of critics of existing programs were all raw materials used for establishing the Desired-state conditions, i.e., the criteria for exemplary programs.

Several studies were conducted comparing student achievement and the affective domain for the kind of science and the level that paralleled the National Assessment of Educational Progress data. These studies were limited since they focused on students at the eleventh grade who were different from all students in a given school. In addition most allowed a comparison at one level only--assuming one wanted to compare students enrolled in an exemplary program at a given grade level with the general situation reported by NAEP.

Relatively few school systems have been recognized in more than one NSTA search. And, when such districts do exist, it is rare that the district is recognized for a science program at the three grade levels used in the National Assessments. One exception to this situation existed with Jefferson County, Colorado. Jefferson County has had multiple programs recognized at both the state and national levels. It provides a unique opportunity to compare students enrolled in such programs taught by teachers who created the programs and at third, seventh, and eleventh grade levels.

Early in 1986 the science department chair was able to get the study approved and to identify three teachers at each grade level who would administer the Preferences and Understanding instrument, one that had been developed from the 1978 affective battery by NAEP and used in numerous Iowa follow-up studies. A total of 1371 students--about equally divided among third, seventh, and eleventh graders--completed the questionnaire. These were forwarded to the investigators for scoring and analysis.

The results of the study are reported in Tables 1, 2, and 3. Corresponding information from three previous studies--all with random samples of students who gave responses to the same items on the questionnaire is included. The differences between students in general nd those found in a district with exemplary programs (and exemplary teaching) are astounding.

Table I provides information concerning student descriptions of their science classes as fun, interesting, exciting, and boring. The greater number of students in Jefferson County who describe their science class as fun is significantly greater at every grade level. In fact at the seventh and eleventh grade level the number of students with such a description of their science class is more than double the number in typical schools. The drop from 83 to 57 per cent who find the study of science fun may indicate the elective nature of science in grade eleven and the great focus on college preparation.

The same results occur with the descriptor "interesting". In this case, however, the drop in number of students who describe their science experiences as interesting in the eleventh grade is less.

Although fewer students report their science classes as exciting, the difference between the general situation found in typical schools and that found in Jefferson County is striking. Students in Jefferson County, especially in the third and seventh grade, find their science classes to be far more exciting than students in randomly selected schools.

When one considers the one negative descriptor for school science, i.e., "boring", the results also favor Jefferson County where exemplary science programs have been found. The one exception is with the third graders where 17 per cent report science as boring--more than double the number in randomly selected schools. The number of students with such a perception remains steady at Jefferson County--where in randomly selected schools the number of seventh and eleventh graders reporting their science classes as boring increases to 30 (seventh grade) and 40 (eleventh grade) per cent.

Table II provides information on student perceptions of how their science classes make them feel. The results are similar to those reported in Table 1. There are slightly more third grade students who report that science classes make them feel uncomfortable. However, the number with such feeling--though similar to the number in third grade--is far less than for students in randomly selected schools. Similarly, the number who report that their science classes make them feel successful in Jefferson County is greater than that found in other schools--and at all three grade levels.

Of great interest is the information reported in Table II about curiosity. The students at all three grade levels in

Jefferson County report that their science classes make them feel curious. That the number for seventh and eleventh grades remains high is reassuring. That it is three times greater than the situation in randomly selected schools is surprising, reassuring, and of significance.

Table III provides information which combines student perceptions in randomly selected schools with those in Jefferson County concerning views of their science teachers. The differences are great. For example, students at Jefferson County feel that their science teachers like to ask questions, like them to ask questions, and like them to share their own ideas at all three grade levels and to a much larger degree than do students in randomly selected schools. Students at Jefferson County do not differ much from other students in their view of their teachers "liking" of science. Third grade teachers generally are not seen as "really liking" science (only a third); however, seventh and eleventh grade teachers are so perceived. It is interesting to note that this perception is even higher at Jefferson County at these two grade levels.

Most science teachers are seen by third graders as having the ability to make science exciting. It is interesting to note that the number with this perception actually increases among seventh graders at Jefferson County while it decreases significantly in other schools. Although the number of eleventh grade students with such a perception decreases at Jefferson County, it is far less of a decrease than that which is found at other schools. Students generally perceive their teachers as knowing much science. Of special interest is the very high percentage of Jefferson County students with such a perception in the seventh grade--which is quite different in general schools.

The student perception of their science teachers as not knowing much information and being willing to admit it is of interest. The situation is quite different at Jefferson County when compared with other schools. The students at Jefferson County at third, seventh, and eleventh grade see their science teachers as ready to admit to not knowing.

The results of this study indicate that positive staff perceptions about science, science classes, and science teachers do exist. Further, they can be maintained across the school years. Apparently exemplary programs and exemplary teaching can inspire students and can result in growth in the affective domain.

The results should encourage teacher educators, science supervisors, and administrators to make concerted efforts to affect student attitudes to a far greater degree. It is certainly apparent that we can not "explain away" negative indicators in the affective domain as unavoidable and merely a matter of maturation. In fact, concerns for student perceptions may be even more vital in terms of real learning than temporary mastery of specific content that is central to textbook presentations, curriculum outlines, and competency testing. Almost total concern for the knowledge domain to the exclusion of other areas--even the process domain--may represent one of the greatest challenges to science education.

The affective domain may be important if real growth is to occur in all other domains and/or if stated objectives are to be met. Teachers and programs seem to affect student attitude rather significantly. Perhaps more time and effort is needed in determining just how teachers and programs exert the effect observed in this study.

Specifically, the following statements can be made as a result of the study reported:

1) Students who experience an exemplary science program and teaching report their science classes to be more fun, exciting, and interesting than students in random situations; similarly they find science to be less boring;

2) Students enrolled in an exemplary science program report their science courses make them feel more successful;

3) Students enrolled in an exemplary science program report science to make them feel more curious across grade levels;

4) Students enrolled in an exemplary science program across grade levels are more positive about their science teachers; specifically, they report more frequently that their teachers ask frequent questions, like them to question, and like them to share ideas;

5) Third grade students are less likely to report that their teachers "really like science";

6) Most students report that their science teachers make science exciting; however, the number with such a perception remains higher across grade levels in a school with exemplary science programs and teaching;

7) More science teachers across grade levels admit to not knowing in exemplary science situations than those found randomly in schools.

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TABLE I

PERCENTAGE OF STUDENTS FROM SETTINGS AND FOR THREE AGE GROUPS WHO RESPOND POSITIVELY ABOUT GIVEN DESCRIPTIONS OF THEIR SCIENCE CLASSES

Sample/ Descriptor	Third Grade				Seventh Grade				Eleventh Grade			
	1977	1982	1984	1986	1977	1982	1984	1986	1977	1982	1984	1986
Science classes are fun	62	57	64	92	33	41	40	83	27	28	25	57
Science classes are interesting	85	86	84	82	42	52	51	85	39	43	46	73
Science classes are exciting	50	56	51	78	43	44	43	72	48	49	40	47
Science classes are boring	4	6	10	17	31	27	29	13	39	41	40	25

1977 - Information from Third Assessment of Science; National Assessment of Educational Progress (n = 2500)

1982 - Information from National Science Supervisors Association Follow-up Study (n = 1800; 400 for adults)

1984 - Information from Iowa Study of Random Sample of Members of National Science Teachers Association (n = 750; 310 for adults)

1986 - Information from Volunteer Science Teachers from Jefferson County (Colorado) (n = 321)

TABLE II

PERCENTAGE OF STUDENTS FROM VARIOUS SETTINGS AND FOR THREE AGE GROUPS CONCERNING DESCRIPTORS OF HOW SCIENCE CLASSES MAKE THEM FEEL

Sample/	Third Grade				Seventh Grade				Eleventh Grade			
Descriptor	1977	1982	1984	1986	1977	1982	1984	1986	1977	1982	1984	1986
Science classes make me feel:												
a) uncomfortable	5	6	6	9	36	20	22	10	43	22	20	23
b) successful	56	58	59	63	42	36	40	57	30	27	30	34
c) curious	43	48	40	80	36	30	24	75	31	24	20	63

1977 - Information from Third Assessment of Science, National Assessment of Educational Progress (n = 2500)

1982 - Information from National Science Supervisors Association Follow-up Study (n = 1800; 400 for adults)

1984 - Information from Iowa Study of Random Sample of Members of National Science Teachers Association (n = 750; 310 for adults)

1986 - Information from Volunteer Science Teachers from Jefferson County (Colorado) (n = 321)

TABLE III

PERCENTAGE OF STUDENTS FROM A VARIETY OF SETTINGS AND AGE LEVELS WHO REPORT POSITIVELY ABOUT SELECTED PERCEPTIONS OF THEIR SCIENCE TEACHERS

Sample/ Descriptors	Third Grade 1977	1982	1984	1986	Seventh Grade 1977	1982	1984	1986	Eleventh Grade 1977	1982	1984	1986
Ask Frequent Questions	61	63	88	92	55	65	75	91	45	54	79	85
Likes You to Ask Questions	52	48	58	80	48	53	55	87	51	53	52	75
Likes You to Give Your Ideas	66	63	66	70	52	40	44	84	44	42	40	86
Knows Much Science	57	60	69	58	65	71	61	88	79	80	81	84
Really Likes Science	37	31	35	31	76	76	78	86	81	80	82	87
Admits to Not Knowing	45	48	44	68	30	23	22	73	17	15	14	65
Makes Science Exciting	70	68	72	73	58	56	51	78	41	45	43	58

1977 - Based on data from Third Assessment of Science, NAEP (n = 2500)

1982 - Based on follow-up survey conducted with NSSA Sample (n = 1800; 400 for adults)

1984 - Based on follow-up survey of National Sample from NSTA members (n = 750, 310 for adults)

1986 - Based on data from Volunteer Science Teachers from Jefferson County (Colorado) (n = 321)

APPENDIX IX

STS ASSESSMENT INSTRUMENTS IN FIVE DOMAINS OF SCIENCE EDUCATION

ASSESSMENT INSTRUMENTS EMPLOYED BY HONORS WORKSHOP PARTICIPANTS

Testing All Five Domains of Science

Introduction

Teachers have long appreciated that science is a complex discipline which includes many facets or domains. Researchers have identified five principal aspects within science including knowledge, processes, creativity, attitudes, and applications. Although these factors are usually included within science courses, dimensions other than knowledge are rarely tested. Analysis indicates that often 90 percent of test items deal solely with the facts of the curriculum, while other important areas are often neglected.

S/T/S courses are effective vehicles for the exploration of domains other than knowledge, and this test package has been designed to show how those areas may be evaluated. It is one goal to illustrate a few of the methods for such assessment are to provide an overview of the testing program. Teachers in S/T/S programs are encouraged to explore other testing ideas which are available in each domain, and to develop their own models for assessment.

FIVE DOMAINS OF CONCERN IN SCIENCE (S/T/S) EDUCATION

Domain I - Knowing and Understanding (knowledge domain)

Science aims to categorize the observable universe into manageable units for study, and to describe physical and biological relationships. Ultimately, science aims to provide reasonable explanations for observed relationships. Part of any science instruction always involves learning by students to some of the information developed through science.

The Knowing and Understanding Domain includes:

Facts
Information
Concepts
Laws (Principles)
Existing explanations and theories being used by scientists
Internalized knowledge which can be used

All of this vast amount of information is usually classified into such manageable topics as: matter, energy, motion, animal behavior, plant development.

Domain II - Exploring and Discovering (process of science domain)

How scientists think and work provides another dimension of science. There are specific and definable processes that characterize human actions that result in new knowledge of the universe. Generally these processes are embodied in the terms "exploring and discovering." Some processes of science which can be used in science instruction illustrate goals/outcomes in this domain:

Observing and describing
Classifying and organizing
Measuring and charting
Communicating and understanding communications of others
Predicting and inferring
Hypothesizing
Testing
Identifying and controlling variables
Interpreting data
Constructing instruments, simple devices, and physical models

Domain III - Imagining and Creating (creativity domain)

Most science programs view a science program as something to be done to students to help them learn a given body of information. Little formal attention has been given in science programs to development of students' imagination and creative thinking. Here are some of the human abilities important in this domain:

Visualizing - producing mental images
Combining objects and ideas in new ways
Producing alternate or unusual uses for objects
Solving problems and puzzles
Fantasizing
Pretending
Dreaming
Designing devices and machines
Producing unusual ideas
Identifying
Isolating
Merging
Diverging
Converging

Much research and development has been done on developing students' abilities in this creative domain, but little of this has been purposely incorporated into science programs.

Domain IV - Feeling and Valuing (attitudinal domain)

In these times of increasingly complex social and political institutions, environmental and energy problems, and general worry about the future, scientific content, processes, and even attention to imagination are not sufficient parameters for a science program. Human feelings, values, and decision-making skills need to be addressed. This domain includes:

Developing positive attitudes toward science in general, science in school, and science teachers
Developing positive attitudes toward oneself (an "I can do it" attitude)
Exploring human emotions
Developing sensitivity to, and respect for, the feelings of other people
Expressing personal feelings in a constructive way
Making decisions about personal values
Making decisions about social environmental issues
Exploring arguments on either side of an issue

Domain V - Using and Applying (applications and connections domain)

It seems pointless to have any science program if the program does not include some substantial amount of information, skills, and attitudes that can be transferred and used in students' everyday lives. Also, it seems inappropriate to divorce "pure" or "academic" science from technology. Students need to become sensitized to those experiences they encounter which reflect ideas they have learned in school science. Some dimensions of this domain are:

Seeing instances of scientific concepts in everyday life experiences
Applying learned science concepts and skills to everyday technological problems
Understanding scientific and technological principles involved in household technological devices
Using scientific processes in solving problems that occur in everyday life
Understanding and evaluating mass media reports of scientific developments
Making decisions related to personal health, nutrition, and life style based on knowledge of scientific concepts rather than on "hear-say" or emotions
Integrating science with other subjects
Taking specific actions designed to resolve problems and/or to improve a local, regional, national, and/or international problem
Becoming involved in community-action projects; extending school experiences beyond the classroom
Emphasizing the interrelationships and interconnectedness of science to other human enterprises

To be meaningful the material in science courses should be related to real life situations. For many this means first focusing on technology which means applications of science. Such applications provide connectors and a means of enhancing creativity and attitude. When these are enhanced more persons can see the value of process and knowledge; perhaps more will advance to these more commonly emphasized domains.

II. PROCESS DOMAIN

There are a wide variety of processes that scientists use to gain new information. Such processes include observing, measuring, predicting, classifying, hypothesizing, and interpreting data. Two samples tests have been developed by the Science Education Center to examine process skills. One test is targeted at grades 4 through 6, and another designed for grades 7 through 9.

A. Notes to Teachers:

1. Choose one of the two process domain tests provided here, or use one of your own design, and administer it as a pre-test.
2. Although the tests were designed for grades 4-6 or grades 7-9, the goal is not to assess reading ability, so use your judgement in the way in which you pursue the test itself.
3. Evaluate the student responses yourself. When you respond to the Chatauqua office, please include an item analysis form which lists the name (or identification number) of each of your students, and their individual responses to each question.
4. Be sure to save a copy of the pre-test results for later comparison with the post-tests.
5. Following your S/T/S unit, give another copy of the same process skills assessment as a post-test.
6. Analyze these post-test results as you did with the pre-tests. Be sure to include a summary statement which discusses growth ---- within your students in the process skills domain. It might be interesting to note growth in specific process skills from pre- to post-test.

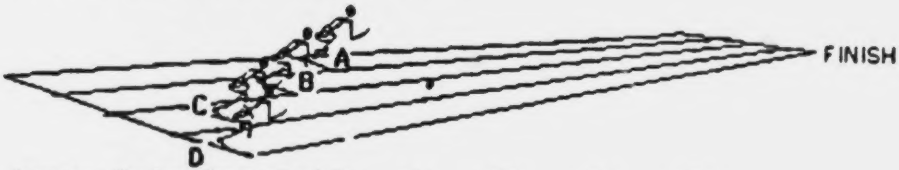
B. References:

1) The Methods and Procedures of Science: An Examination (Woodburn)
2) Test of Inquiry Skills (Fraser)
3) Wisconsin Inventory of Science Processes (Welch)
4) Cedar Rapids Schools Science Process Measure (Phillips)
5) EPIE Science Process Test (Wallace)
6) Scientific Curiosity Inventory (Campbell)

Assessment model
for Science Process Domain
(Grade 4-6)

Direction:
1. Cross or check the letter in front of the most appropriate answer
2. Try to answer all of the question BY YOURSELF›
3. Time LIMIT - 15 minuts.

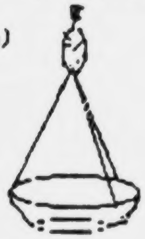
1. (Using space/time relationship)
Look at the runners in the race. If all the runners get to the finish line at the same time, who will have to run the fastest?



Answer: the boy from start line ‹A› ; ‹B› , ‹C› , ‹D›

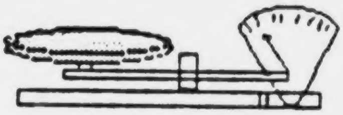
2. (Design of experimental procedure)
If you have three oranges each weighs 1/4, 1/2, and 3/4 pound, which scale is the most accurate to weigh the oranges one at a time?

a)



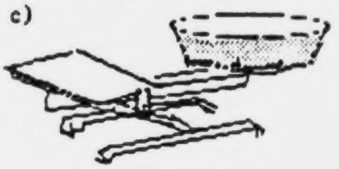
weighs up to 1 pound

b)



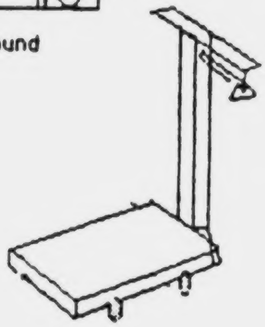
weighs up to 1/2 pound

c)



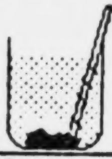
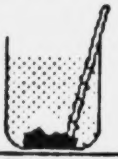
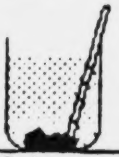
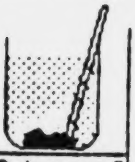
weighs up to 10 pounds

d)



weighs up to
200 pounds

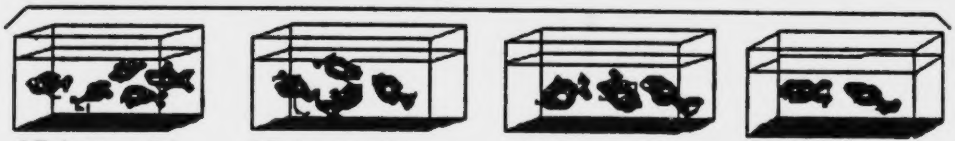
3) (Hypothesizing)
The hotter the water, the faster sugar will dissolve. Look at the jars. Each jar has the same amount of sugar. Put the jars in order from the slowest to the fastest dissolving

sugar in the water	A 	B 	C 	D 
temperature	80 degrees F	40 degrees F	100 degrees F	140 degrees F
dissolving time	5 minutes	7 minutes	3 minutes	1 minute

Answer: A) A, B, C, D B) B, A, C, D
C) C, B, D, A D) D, C, B, A

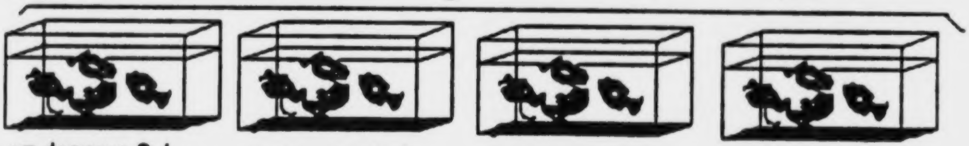
4. (Experimenting/observing).

A



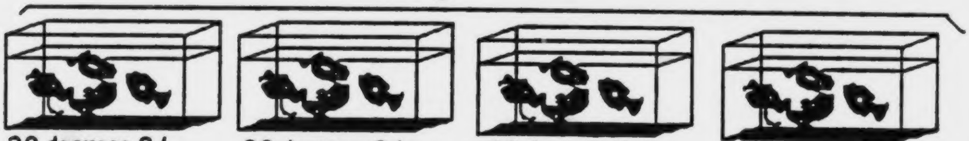
25 degrees C/ 5 goldfish | 25 degrees C/ 4 goldfish | 25 degrees C/ 3 goldfish | 25 degrees C 2 goldfish

B



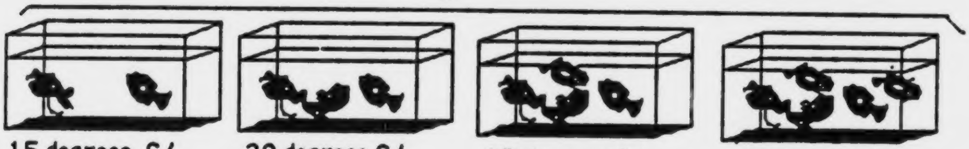
15 degrees C / 4 goldfish | 20 degrees C / 4 goldfish | 25 degrees C / 4 goldfish | 30 degrees C / 4 goldfish

C



20 degrees C/ 4 goldfish | 20 degrees C/ 4 goldfish | 20 degrees C/ 4 goldfish | 20 degrees C/ 4 goldfish

D



15 degrees C/ 2 goldfish | 20 degrees C/ 3 goldfish | 25 degrees C/ 4 goldfish | 30 degrees C/ 5 goldfish

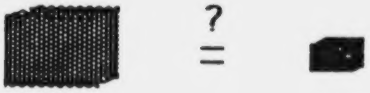
You want to test and find out what temperature is best for goldfish. Which row of tanks would you choose to start your test?

Answer: A) group A B) group B C) group C D) group D

5. (Comparing and Differentiating)

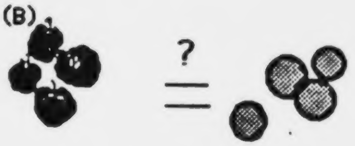
Which pair of pictures below is the best comparison?

(A)



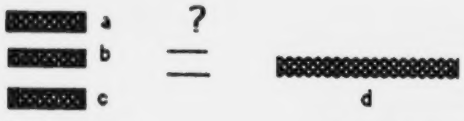
1 pound of cotton | 1 pound of rubber

(B)



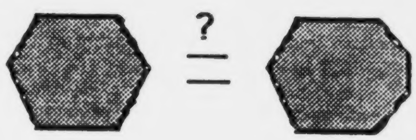
4 apples | 4 balls

(C)



the length of <a+b+c> | the length of of <d>

(D)

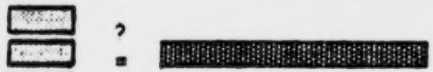


the number of angle in shape A | the number of angle in shape B

6 (Measuring)

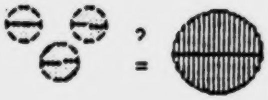
Which pair of pictures below is closest to equal?

a)



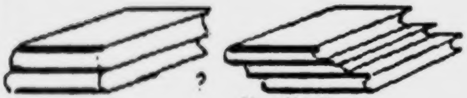
the length of three bricks

b)



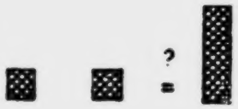
width of 3 balls?

c)



the thickness of 2 books?

d)

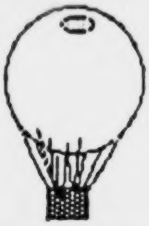


the height of 2 blocks?

7 (Hypothesis testing)

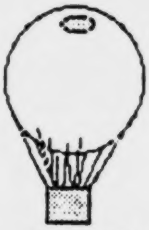
If the same amount of a gas is in the following balloons, which balloon do you think will float up fastest ?

a)



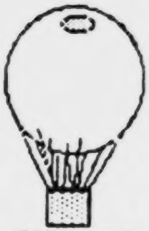
weight: 1000 pounds

b)



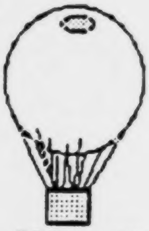
800 pounds

c)



500 pounds

d)

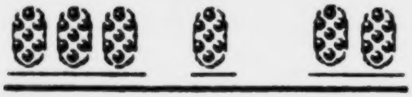


200 pounds

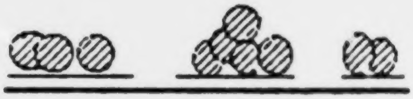
8 (Using number)

Which of the picture groups below is put in order from the smallest to the largest number?

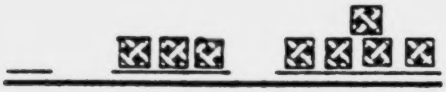
a)



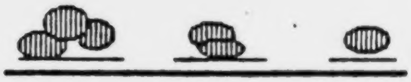
b)



c)



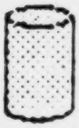
d)



9 (Predicting)

Look at the picture below. Which item will sink the fastest in a pan of water?

a)

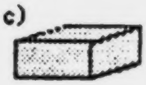


an empty can

b)

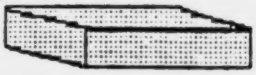
a glass marble

c)



a wood box

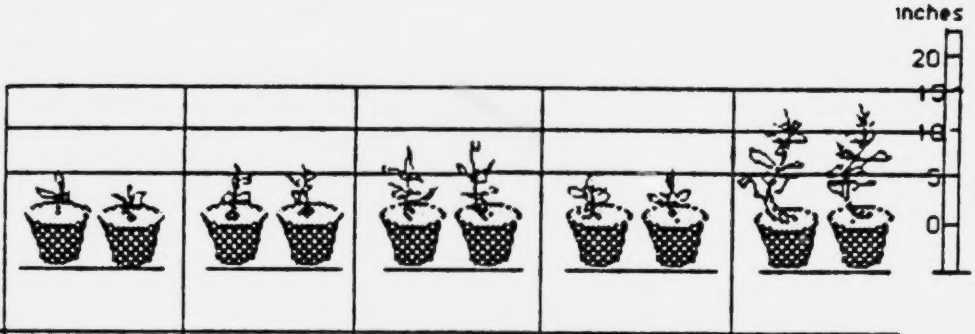
d)



a piece of sponge

10. (Drawing conclusions from experiments).

Here is an experiment that shows how much peanut seed grew in 20 days.



DATA					
growing time	20 days	20 days	20 days	20 days	20 days
amount of plant food	2 grams	2 grams	2 grams	2 grams	2 grams
water added	50ml/ day	75 ml/ day	100 ml/ day	60 ml/ day	150 ml/ day

Look at the chart above What would you say about this experiment?
Choose from the answer below.

a) The more plant food added, the faster the plant grew
b) The more water added with a certain amount of plant food, the faster the plant grew
c) The more water added with a certain amount of plant food, the slower the plant grew
d) the more plant food added with a certain amount of water, the slower the plant grew.

Your name : ______________________
Your grade: ______________________
Gender : ______________________
Date : ______________________

ANSWER KEY FOR THE EVAUATION OF STUDENTS IN THE PROCESS OF SCIENCE DOMAIN.

(For use with the 4-6 grade process assessment instrument)

Question no	Answer	Reason
1	D	Track D is the longest distance . If all of the runners started at the same time, and they also arrived at the FINISH line at the same time, it means that the runner who started from line D must be the fastest.
2	A	The weights of the oranges are 1/4, 1/2, and 3/4 pounds. If you use the B scale, the orange which weighs 3/4 pound cannot be weighed, and the orange which weighs 1/2 pound could not be weighed either if the scale does not work properly. Using the C or the D scale would be less accurate. So the most correct answer would be A.
3	B	Based on the data stated in the hypothesis, the most correct order could be [B,A,C,D] or [D,C,A,B]. Since you are asked to put the items in order from the slowest to the fastest dissolving then, the only correct answer would be [B,A, C, D] and this order is provided in option B
4	B	Since you have to observe the optimal temperature where a fish can live what you have to do is to maintain the other variables while observing the effect of the temperature changes on the fish behavior. Option B provides this requirement. You maintain the number of the fish while changing the temperature. The other options could not be correct.
5	A	What implied in this option is that no matter what substances you are comparing the weight (1 pound) will be the same.
6	C	Before answering the question you have to measure the length, the height or the thickness of the objects compared. You will find that the thickness of two books is the same as the one which consists of three books.
7	D	There is the same amount of gas in each of the four balloons. The weights on the balloons is unequal. Therefore, the one with the smallest amount of attached weight will float up fastest. This is true with D.
8	C	Option C provides the correct answer by showing an order of [0,3,5], that is an order from the smallest to the largest number. The other options could not be correct since they provide incorrect order.
9	B	Based on the shape of the object you can predict that the glass marble egg will sink down in the **plain water**. The other objects would float.
10	B	Based on the data provided, the more water added with a certain amount of plant food, the faster the growth of the plant. And this is accomplished by option B.

Assessment model
for Science Process Domain
(for grade 7-9 students)

Direction:
1. Select the best answer by encircling the letter in front of your option.
2. Time limit is 15 minutes.

---

1. (Experimenting & Observing)
Gloria wants to determine the optimal temperature where a fish can live conveniently in the water. Which first action do you think will be most appropriate for her to determine this?

a. Put 6 kinds of fish in 6 different aquaria and keep the temperature in each aquarium constant at 25°C.
b. Put 6 fish in an aquarium. In interval of 10 minutes change the water temperature from 10°C to 15°C; to 20°C; to 25°C; to 30°C; to 35°C; and finally to 40°C. Observe the behaviors of the fish after each temperature changing.
c. Get 6 aquaria, put 6 similar fishes in each aquarium, keep the temperature of the water constant at about 25°C, and observe the behavior of the fish in each aquarium.
d. Get 6 aquaria, put 6 similar fishes in each aquarium with the temperature of water varied from 15, 20,25, 30, 35, to 40°C in each aquarium. Observe the behavior of the fish in each aquarium.

2. (Comparing and differentiating)
Which statement is correct for comparing and differentiating things?

a. Don weighs a bunch of grapes on the table.
b. Don measured the weight of 5 grapefruits and 5 apples.
c. Don found that the average weight of an apple is 2/3 that of a grapefruit.
d. Don found that the length of Johnson street is 3 miles.

3. (Classifying and/or Grouping)
Here are data concerning with plants and their parts which are edible.

plant name	part of the plant which is edible			
	(plant stem)	(flower)	(leaf)	(fruit)
spinach	X		X	
sun flower		X		
jack fruit				X
tomato				X
cabagge		X	X	
egg plant				X

Based on the data above, state the smallest number of groups to classify the plants.

a. 1 b. 2 c. 3 d.4

4. (Quantifying)

If 1 pound is equivalent to 0.454 kg and equal to 0.454 liter of water with the density of 1.0, then which one of the following facts is nearly correct.

a. 1 liter of water is about the same weight as 2.2 pounds of banana.
b. 2 liters of water has approximately the same weight as 2 pounds of grapes.
c. 1 liter of water is about the same weight as 1 liter of cooking oil.
d. 2 kg of cabagge is approximately the same as 2.2 pounds of pineapple.

5. (Measuring)

The length of an iron bar is 3 times the length of a new pencil. The half length of the pencil is 11 cm.
Which information matches with the above data ?

a. The length of a piece of brick, which is a half of the length of the iron bar, is 11 cm.
b. The length of the iron rod is 43 cm.
c. The total length of two new pencils would be the same as 2/3 of the length of the iron rod.
d. the length of a wood bar which is 3 times of a pencil's length would not the same as the length of the iron bar.

6. (Using space time relationship)

You have 20 minutes to ride your bicycle from your house to your friend's house which is 5 miles in distance. Assuming that there is no interference on the road, how many miles per hour should be your average speed to arrive at your friend's house on time?

a. 10 miles/hour　　b. 15 miles/hour
c. 20 miles/hour　　d. 25 miles/hour

7. (Identifying and Differentiating)

The following three substances can mix homogeneously, and their individual properties can be simplified as follows:

Substance name	Specific properties			
	(density)	(boiling point)	(melting point)	(appearance)
Allurgy A	2.3	1000°C	400°C	metalic
Allurgy B	1.4	600°C	50°C	metalic
Allurgy C	1.2	475°C	10°C	metalic

Which is the correct way to identify and differentiate the individual substances?

a. At temperature about 40°C, allurgy A will precipitate in the liquid of allurgy B and allurgy C will float in allurgy B
b. At temperature about 500°C the three substances will be easily separated.
c. At temperature bellow 10°C the three substances will be distinctly different.
d. You can separate the three substances by dropping the temperature of the mixture from about 470°C to 390°C then to 45°C.

8. (Deducting)
From the data in question number 7 the following thing can be deducted.

a. Below the melting point, every substance will be in its solid state.
b. At temperature between boiling point and melting point, you can separate homogeneous mixture easily.
c. You cannot separate substances based on their boiling points.
d. You can separate substances easily based on their density, when they mix homogeneously.

9. (Inferring)
Referring to the data in question number 7 you can infer that:

a. Separating a homogeneous mixture would be easy if you drop the temperature of each component from its liquid state to its solid state.
b. If you suddenly drop the temperature of the mixture from the highest melting point of a component to the lowest boiling point of the other component, you will get the individual component easily.
c. Increasing the temperature from the melting point to the boiling point will cause the mixture to be separated easily.
d. Lowering the temperature from the boiling point to the melting point of each component of the mixture will cause the substance melts.

10. (Cause and Effect relationship & Drawing conclusion)
The following data is taken from an experiment:

Temperature (average)	seed weight (gram)	water consumed (mL/day)	exposure to light (minutes/day)	plant height (cm/20 days)
20°C	2.2	10	20	20.2
25°C	2.3	10	20	20.3
30°C	2.3	10	20	20.2
25°C	2.1	10	20	20.3
25°C	2.3	10	30	21.9
25°C	2.2	10	40	22.8
20°C	2.2	10	30	21.8
20°C	2.1	20	30	21.9
20°C	2.2	30	30	22.0

Based on the data above, what factor do you think influences mostly the speed of the plant growth?

a. The temperature where the plant is grown.
b. The seed weight.
c. The amount of water consumed every day .
d. The length of the period the plant is exposed to the light.

11. (Predicting)

Based on the data in question number 10, the following prediction could be correct.

a. Adding the length of the period of the exposure to light could increse the height of the plant.
b. Adding the amount of water consumed every day could increase the height of the plant.
c. Increasing the temperature could increase the height of the plant
d. Using the heavier seed could increase the height of the plant.

Thank you very much!!

Date :...
Your name :...
Your grade :..
Gender :..

ANSWER KEY FOR THE EVALUATION OF STUDENTS IN THE PROCESS OF SCIENCE DOMAIN

(For use with 7-9 grade process assessment instrument)

Question No.	Answer	Reason
1	D	6 different aquaria, each with different temperature, will enable the student to control the temperature variable. 6 fish in each aquarium will make the observation of behavior much easier.
2	C	The comparison is stated clearly by mentioning that the average weight of an apple is 2/3 that of a grapefruit. Such comparison is not available in the other options, so you will not be able to tell the difference the other things.
3	B	You can classify those plants into two groups, one group has members of plants which have more than one edible part, while the other one has only one edible part. The other options could not be correct.
4	A	1 liter of water is equivalent to 1 kg of water and this is equivalent to 2.2 pounds of anything, including banana.
5	C	The length of a new pencil is 2 X 11 cm = 22 cm. The length of the iron bar/iron rod is 3 X 22 cm = 66 cm. The length of 2 pencils is 2 X 22 cm = 44 cm. So, 44 cm is 2/3 of 66 cm.
6	B	5 miles is achieved in 20 minutes or 5 X 3 (miles) in 20 X 3 (minutes). This means that the average speed should be 15 miles/hour.
7	D	At 470°C the three substances are in liquid states. At 390°C compound A is in the solid state while the other two are in the liquid state. Material A will fall out of the solution and can be separated. At 45°C Material B is in the solid state and can be separated from liquid of Material C.
8	A	At temperatures below the melting/freezing point, every substance is in the solid state. At temperatures between the melting point and boiling point, every substance will be in the liquid state. At temperatures above the boiling point, each substance would be in the gaseous state.
9	A	The main idea of this separation is that you have to prepare a condition in which two different substances are in two different states at the same time. Remember that they are in a homogeneous mixture! The method in A is the easiest while the other methods are very difficult to do.
10	D	Look at the plant-height column. Note that there is a significant difference in size with some seed treatments. In this problem, the data are shown on the second-group row. The only factor whose value changed is the exposure to light.
11	A	Based on the above experimental data, you can predict that to some extent, increasing the time that the plant is exposed to light (while keeping other factors constant) will produce a taller plant.

III. CREATIVITY DOMAIN

Creativity is certainly one of the most challenging domains to assess, but several instruments do exist. Several examples have been provided for possible use in an attempt to see just how creative the students are. It is our hope that students will enjoy this form of evaluation as they begin to understand that creativity if an essential part of science.

A. Notes to Teachers:

1. Choose one of the creativity test types provided here, or use of your own design, and administer it as a pre-test before you begin your unit. Within any test format, please use the suggested question or scenario, or "create" an additional one which you feel would be more appropriate for your students.
2. Evaluate the student responses yourself, and send all answer sheets to the Chautauqua office as soon as possible. Please include an analysis form which lists the name (or student number) of each of your students, and their score.
3. Be sure to save a copy of the pre-test results for later comparison with the post-tests.
4. Following your S/T/S unit, give another creativity test as a post-test. It would be fine to simply change the question or scenario, but the basic form of the test should be the same.
5. Send these post-tests and your analysis sheet to the Chautauqua office as soon as possible. Be sure to include summary of the results you see when you compare the pre- and post-tests. Please make some general statements about growth seen within your students in the domain of creativity.

B. References:

Included here are other types of creativity tests to which you might like to refer:

1) Purdue Creativity Test (Lawshe, et al)
2) Torrance Tests of Creative Thinking (Torrance)
3) Modes of Thinking in Young Children (Wallach, et al)

CREATIVITY VIA ONE'S IMAGINATION

I. Directions:

1 Using the sample answer sheet (or something similar) make enough copies for each student AND for each question given.

   (a) This is done to help in quantifying and evaluating the responses.

   (b) If copying the sample is not possible, please have the students follow the sample format closely.

2. Have students write as many pertinent and imaginative responses as possible.

   (a) The concern here is with both quality and quantity of responses.

   (b) Answering in paragraph form may seem better, but this makes evaluating responses much more difficult.

   (c) Examples of answers for question #1 might be: "People will float away." and "There would be no wind."

3. Please read the general instruction sheet which is also included in this packet.

II. Method of Teacher Evaluation of Student Responses:

1. Record number of pertinent answers for each student.

2. Record number of responses from each student which you feel are creative and/or unique. Examples for question #1 might include: "Car wheels would no longer 'stick' to the road." and "There would be no curve balls in baseball."

III. Sample Questions:

1. Describe what would happen in a world without gravity. (You can substitute air, light, plants, and etc. for the word gravity.)

2. If you were an atom, list some responses which would help describe you. (You can substitute for the word atom.)

CREATIVITY VIA ONE'S IMAGINATION

Answer Sheet

Name:____

Teacher's Name:__________________________________

Age:__________________ Grade:__________________

Sex:__________________ Date:__________________

STUDENT DIRECTIONS: Please read the following question and after thinking about it for a minute or so, write down as many responses as you can which you feel are correct. Be as imaginative as you possibly can be without straying to far from what the question is asking.

Question #_____:

GOOD LUCK!!

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THINKING BEYOND

SCORING DIRECTIONS

Because this creativity test was modelled after Torrance's**, the definitions of terms and a good part of the scoring directions listed below are basically excerpts from his Directions Manual and Scoring Guide for verbal test booklets A & B. The test can be given basically three distinct scores: Fluency, flexibility, and originality.

1. Fluency:

Defined as the total number of relevant responses, relevancy being defined in terms of the requirements of each activity.

2. Flexibility:

Refers to the range of major categories under which the different responses on each activity can be grouped. Some categories are listed later in the directions that would give you some idea. The categories identified here are should not be a limiting factor. New categories can be founded if a response does not fit in.

3. Originality:

Refers to the 'creative strength' expressed in a particular response. It may be helpful to think of responses showing no creative strength as being characterized by requiring little intellectual energy; that is little intellectual energy is necessary to give obvious, common, and learned responses. In contrast, more intellectual energy is required to give responses characterized by going beyond what is learned, practiced, habitual, and away from the obvious and common place. These latter types of responses are the kinds of responses that are thought of as "showing creative strength".

DESCRIPTION OF SCORING

I. Fluency: Simply count the number of relevant responses.

II. Flexibility: One point will be scored for each of the following categories used in asking questions. No credit is given if a category is repeated. For instance, if 4 questions are asked concerning the character's emotional state, only a score of 1 is given. A few typical examples will be given for scoring flexibility points for each category in attempt to define it. No attempt will be made to be exhaustive.

In instances when responses cannot be fit into categories listed below, new categories should be created. Please introduce those, and designate them by "X1" for the first new category, "X2" for the second new category, etc.

To calculate the flexibility score for each activity, add the number of categories used.

** Torrance, P. E. (1966). Torrance tests of creative thinking. Bensenville, IL: Scholastic Testing Service, INC.

General Flexibility Categories For Activities 1, 2, 3.

ASKING QUESTIONS

1. CHARACTERS IN STORY, ideas about causality brought about by the physical qualities of the story; i.e.,
    Was Jane alone?
    How old is she?
    Did she have enough money?

2. CHARACTERS OUTSIDE STORY, including people and animals:
    Were there other people in the station?

3. EMOTIONAL, psychological, mental causes:
    Was she nervous when she got there?

4. ETHNIC, includes questions about race, religion, language:
    Was she caucasian?

5. FAMILIAL / INSTITUTIONAL causes:
    Did the owners of the station have some trouble/sickness in the family?
    Did the station close down?

6. LOCATION, includes causation related to where she is, was, or will be.
    Was the station far out in the country?

7. OCCUPATION, related to job or status
    Was she denied fuel because she did not have proper identification?

8. PHYSICAL ACTION IN STORY:
    Was the station open to start with?

9. SETTING, factors associated with the natural landscape:
    Was the station located on a dangerous slope?

10. TIME:
    What time of the day was it?
    Was it on a holiday?

11. WEATHER:
    What was the air temperature?

12. SKILL/FAMILIARITY:
    Has she been to the station before?
    Has she used that type of nozzle before?

13. PHYSICAL ACTION OUTSIDE STORY:
    Was there a gas shortage in the country?

14. MAGIC
    Is she usually lucky?

GUESSING CONSEQUENCES CATEGORIES

1. CHARACTERS IN STORY
   She asked people to help.
2. CHARACTERS OUTSIDE STORY
   Some people offered her fuel.
3. EMOTIONAL
   She got very upset.
4. LOCATION
   She went to another gas station.
5. OCCUPATION
   She realized that she is already late for her job.
6. TIME
   She recorded their opening hours, and went there again later.
7. SKILL/FAMILIARITY
   She asked a friend to teach her how to use the nozzle.
8. PHYSICAL ACTION OUTSIDE STORY
   She decided to start a rally against the fuel shortage.
   She decided to go use her bicycle.
9. MAGIC
   She decided to put a horse-shoe in her car.
   She decided to wear her lucky ring.

GUESSING CAUSES

1. CHARACTERS IN STORY
   She did not have her check-book or credit card.
2. CHARACTERS OUTSIDE STORY
   There was a long queue of people at the station.
3. EMOTIONAL
   She had forgotten that she had filled her car with fuel the evening before.
4. ETHNIC
   She was harassed because of her skin color.
5. FAMILIAL
   Her son hurt himself as she arrived: she had to take him to the hospital right away.

6. OCCUPATION
At the moment she got there, her beeper went on and she had to return immediately to the hospital.

7. PHYSICAL ACTION IN STORY
The station was closed for maintenance.

8. TIME
She arrived after the service hours.

9. WEATHER
It was so windy and cold that she changed her mind.

10. SKILL / FAMILIARITY
It was the first time that she try to use the nozzle: did not know how.

11. PHYSICAL ACTION OUTSIDE STORY
There was a gas shortage in the State.

12. MAGIC
It happened on a Friday, the 13th of the month.

III. Originality: It is not easy to decide a priori which response is obvious and easy and which is not, especially when dealing with students of different age groups and backgrounds. When having a great number of responses, one can more or less decide objectively on the creative strength based on the frequency of those responses, and provide examples from one's experience that would make the scoring task easier. Because the scenario used on this instrument has not been used before, we do not have any way of predicting what kinds of responses would qualify as original and which ones don't. Consequently we cannot provide you with a list of examples.

When dealing with a large pool of criteria the following guidelines are used:

- a score of zero to a response when given by 5% or more of the respondents.
- a score of one point when given from two percent to 4.99 of the respondents.
- a score of two points to a response when given by less than two percent.

You can use these guidelines to estimate roughly the originality scores of students in your class. Or, if you do not want this experience for your own information in preparing and using similar exercise, you have the option of sending back to us the test booklets to perform the analysis.

****

THINKING BEYOND

ADMINISTRATION PROTOCOL

It is recommended that a brief orientation to the students be given before the test forms are distributed. To the extent possible try to arouse the group's interest and motivation for the activities. A variation of the following is suggested by Torrance:

> "We are going to do some things that will give you a chance to see how good you are at thinking up new ideas and solving problems. They will call for all the imagination and thinking ability you have. So I hope that you will put on your best thinking cap and that you will enjoy yourself."

After the test forms are passed out, you can continue by saying:

> These activities "will give you a chance to use your imagination in thinking up ideas and putting them into words. There are no 'right ' or 'wrong' answers like there are in most things that we do. We want you to see how many ideas you can think of, and we think you will find this fun. Try to think of interesting, unusual, and clever ideas-something that no one will think of."
>
> "You will have three different activities to do and you will be timed on each one, so make good use of your time. Work as fast as you can without rushing. If you run out of ideas before time is called, wait until instructions are given before going to the next activity. Sometimes if you will just sit and think, more ideas will come to you and you can add those.
> If you have any questions after we start, raise your hand and I shall come to your desk and try to answer your questions."

If there are no questions, proceed with the first activity. Read the instructions and the story aloud. Avoid giving examples or illustrations of model responses' as this tends to reduce originality and possibly the number of responses produced.

Give five minutes for each activity, after you read aloud the instructions for each.

THINKING BEYOND

Name:______________________________

Teacher's Name:______________________________

Age:____________________ Grade:____________________

Sex:____________________ Date:____________________

The first three activities will be based on the situation described below.
These activities will give you a chance to see how good you are at asking questions to find out things that you don't know and in making guesses about possible causes and consequences of happenings. What is happening? What can you tell for sure? What do you need to know to understand what is happening, what caused it to happen and what will be the result?

JANE STOPPED AT THE GAS STATION TO OBTAIN FUEL FOR HER CAR. TO HER DISMAY SHE WAS NOT ABLE TO GET ANY.

Activity 1. **ASKING:** On this and the next page, write all of the questions you can think of that will help you understand the situation described above. List all the questions you would need to ask, or want to know to be sure what is happening.

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Activity 2. **GUESSING CAUSES:** In the spaces below, list as many possible **causes** as you can for what is described in the story. You may think of things that might have happened just before what has happened in the description, or something that happened a long time ago that made these happen. Make as many guesses as you can.

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Activity 3. **GUESSING CONSEQUENCES:** In the spaces below, list as many possibilities as you can of **what might happen in the future** as a result of what is taking place in the story. You may use things that might happen right afterwards or things that might happen as a result long afterwards in the future.
Make as many guesses as you can. Don't be afraid to guess.

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AN INSTRUMENT FOR ASSESSING SOME ASPECTS OF CREATIVITY IN SCIENCE

Leonardo Sanchez
Science Education Center
Van Allen Hall
The University of Iowa
Iowa City, Iowa

SOME CONSIDERATIONS ON EVALUATING CREATIVITY

A Note to STS Teachers

As newcomers to the field, we are aware that much work has been done in the area of creativity, and we are not so naive to pretend that we are going to make a revolution with a few day's work.

Instead, for the time being we propose that our approach should consist in taking one of the current trends whose characteristics might be useful for our purposes of evaluating the effects of an STS teaching format on student's "creativity."[1]

The first striking thing upon embarking on a quick review through the literature on creativity is the lack of agreement on a definition of creativity that might serve for all fields of human endeavor.

On second thought, this should not be a surprise at all since what is deemed "creative" is tied to statements of value and, according to logicians, it is very difficult if not impossible to reach universal agreement regarding these types of statements.

Thus to turn the question around, just as we can identify several domains of Science without getting into an endless debate of what is Science as a whole, or establishing descriptions which will satisfy everybody's criteria, or pretending that the simple linear sum of the identified domains make up the whole of Science, we propose that we try to reach an agreement on what we consider are some important aspects or components of "creativity" in science, and see if we can come up with simple instruments that might evaluate change in these identified aspects without pretending that we are measuring changes in "creativity" as a whole. This is a much larger and complex issue beyond our present task.

Several people have proposed that the notion of creativity to be used in science should be "THE SOLVING OF A PROBLEM WITH SOLUTION UNKNOWN TO THE SOLVER UPON INITIAL CONFRONTATION WITH THE PROBLEM."

At least one known philosopher of science (L. Laudan) has attempted to describe most of science as a problem solving enterprise, so the initial assumption is not implausible, particularly if we do not claim that creativity in science as a whole is only related to problem solving abilities; using the jargon of scientists, we might consider these as NECESSARY conditions but not SUFFICIENT.

This notion of creativity leads to a taxonomy that must include at least the following components:[2]

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[1]. Gehlbach, R. D., Journal of Creative Behavior, Vol. 21, No. 1, pp. 34-37.

[2]. Ibid.

1. Recognition of a problem;
2. Definition of the problem to be solved;
3. Generation of alternative possible solutions;
4. Testing of alternative possible solutions;
5. Selection of the best solution.

Again let us not fall into the trap of believing that these constitute the sufficient components of creativity in science; let us just assume that these are necessary components.

It is based on such premises that we present for your consideration the following questions/tasks which we claim DO NOT measure creativity as a whole, but only certain elements of creativity in problem solving.

ANAXIMENES' PROBLEM
Leonardo Sanchez

According to Sarton[1], Anaximenes of Miletos (6th century B.C.) used this crude experience to convince himself about some of the merits of his formulation that Air (pneuma) was the primary substance of the Universe, that adopted all kinds of appearances by condensation or thickening (pycnosis) or by rarefaction or thinning (manosis) in association with changes in temperature.

Unfortunately his conclusion was the opposite of what we now accept as truth. Only until the resurgence of Atomism beginning in the 17th century, was a suitable explanation provided in terms of a corpuscular model.

Correct or Appropriate Answers

Defining the problem:

1. (b) Assign 1 point if correct.
   (a) Assign 1 point if correct.
   (-)
   (c) Assign 1 point if correct.

Assign to question 1 the sum of points obtained (0, 1, 2, or 3).

2. (d) Assign 2 points if correct.

Formulating an explanation or solution of macroscopic behavior (trying to explain how it happens).

3. (b) Assign 2 points if correct.

Testing the solution or explanation.

4. (c) Assign 2 points if correct.

Basing the explanation in terms of a model (trying to explain why it happens).

5. (b) Assign 2 points if correct.

6. (d) Assign 2 points if correct.

7. (a) Assign 2 points if correct.

The present draft of this problem owes much to the valuable suggestions and commentaries of Ed Rezabeck.

---

[1] Sarton, George: A History of Science: Volume 1, p. 177, W.W. Norton & Co., New York, 1952.

GREETINGS!

Before answering the following questions we need you to provide us with your identification number, age and sex.

Except for question 1 which has its own instructions, cross or encircle the letter beside the answer you consider correct.

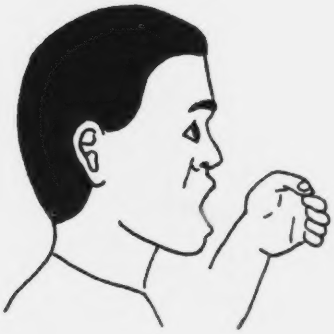
We encourage you to work individually and to do your best. Feel free to do any drawing that might help you understand better the situation.

RELAX AND ENJOY!

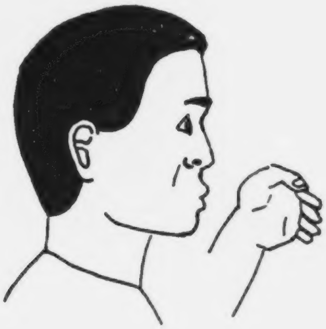
I.D. Number ________________

Age________________ Sex________________

IF YOU BLOW AIR ON YOUR HAND KEEPING YOUR MOUTH WIDE OPEN, YOU CAN FEEL ON YOUR HAND THAT THE AIR IS WARM.



NOW IF YOU BLOW AIR ON YOUR HAND KEEPING YOUR MOUTH ALMOST CLOSED YOU CAN FEEL ON YOUR HAND THAT THE AIR IS SLIGHTLY COLD.



1. If you were given a very sensitive thermometer, how would you determine if the change of temperature felt by the hand is due to:

   a) The effect of the air on the hand (slow in one case, fast in the other);

   b) Something that happened to the air before reaching your hand;

   c) An illusion caused by trying to use the hand as a temperature measuring device.

Note: Below is a list of ways that you could use to test a, b, and c above. Match the testing method below to the explanation.

( ) While blowing with the mouth almost closed, measure the temperature of the air inside the mouth, and measure the temperature of the air before it strikes the hand.

( ) While keeping the mouth almost closed, blow on the thermometer at different speeds.

( ) While blowing with the mouth wide open, measure the temperature of the air inside the mouth, and while blowing with the mouth almost closed, measure the temperature of the air inside.

( ) Blowing with the mouth wide open on the thermometer and blowing with the mouth almost closed on the thermometer.

2. Student A says that what is happening with the air blown on the hand is similar to what happens when air is blown by an electric fan within a closed room. The faster air is blown, the cooler it feels and not because the air changed its temperature.

   Student B argues that these are not similar situations. The temperature of the air within the room, which the fan blows around is less than skin temperature, and the cooling effect caused by the air is due to this difference in temperature, while the air coming out of the lungs into the mouth is slightly above skin temperature.

   What experimental result would show that the argument of student B is wrong.

   a) A fan causes a warming effect by blowing air with a temperature below skin temperature.

   b) A fan causes a warming effect by blowing air with a temperature slightly above skin temperature.

   c) A fan causes a cooling effect by blowing air with a temperature below skin temperature.

   d) A fan causes a cooling effect by blowing air with a temperature slightly above skin temperature.

3. Supposing that you have determined that the air changes its temperature before reaching your hand.

   Which would be the most reasonable explanation related to this experience?

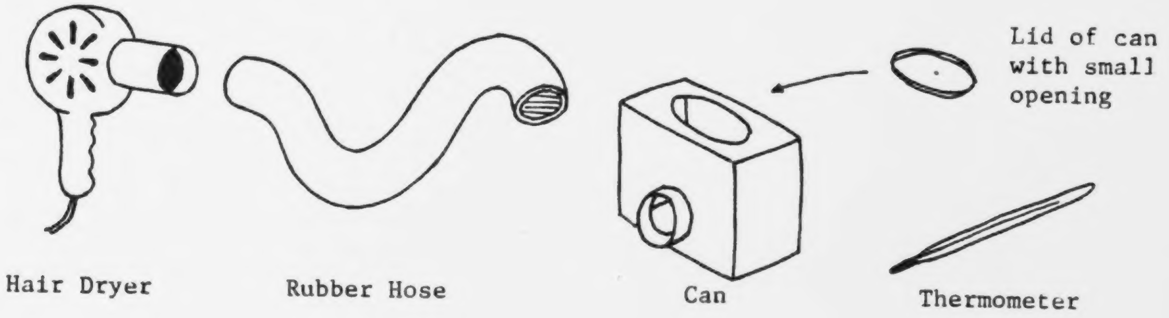
   a) When air is squeezed or compressed slowly within the mouth it stays warm, and when air is squeezed or compressed rapidly within the mouth it cools down.

   b) When air comes out of a large opening (and at a slow speed) it stays warm, and when air comes out of a small opening (and faster than before) it cools down.

   c) When air comes out of a large opening (and at a slow speed) it cools down, and when air comes out of a small opening (and faster than before) it stays warm.

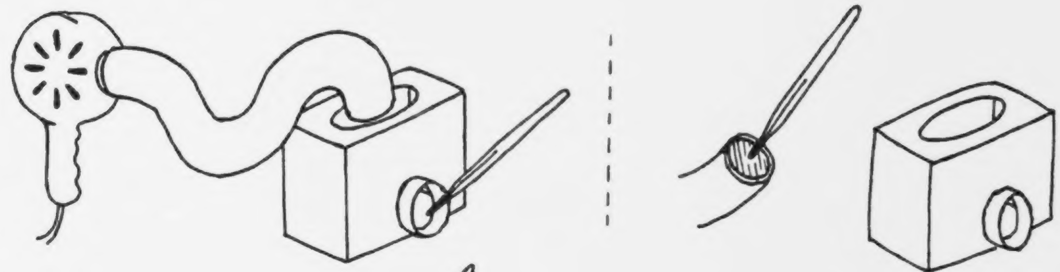
   d) When air comes out of any opening, large or small, it cools down, depending on the distance it travels.

4. IF YOU COULD USE THE FOLLOWING EQUIPMENT


Lid of can with small opening
Hair Dryer
Rubber Hose
Can
Thermometer

HOW WOULD YOU TEST YOUR EXPLANATION?

a)



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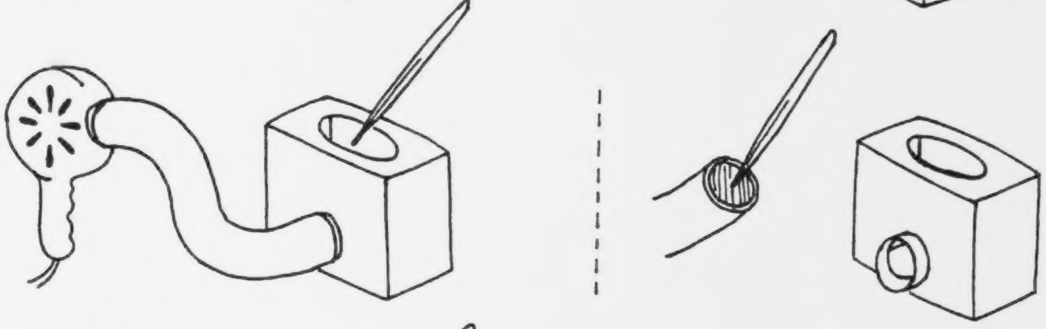

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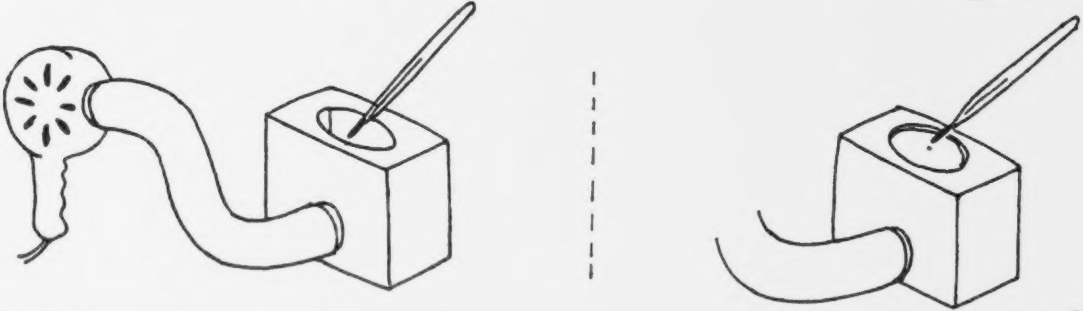

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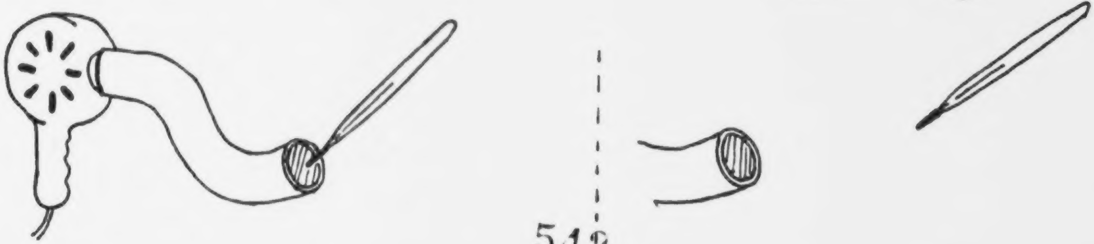

End of test for 4th and 5th grade.

5. If you had been able to do the experiments, by now you would have determined HOW the temperature of the air is affected when it passes through small openings.

A MODEL that tries to explain observations on air pressure and temperature, consists of imagining air as formed of very tiny particles, invisible to the eye, bouncing around in all directions at great speed, colliding against the walls of the object which contains them, but not colliding against each other.

In this model, the speed of these tiny particles is related to the temperature of the air, the greater the speed of the particles, the higher the temperature of the air.

This last statement seems to be opposite to our first experience that the air feels WARM when it is coming out of the mouth SLOWLY and that it feels COLD when it is coming out FAST.

Which of the following statements would explain this.

a) The tiny particles do not have all the same speed, when there is a wide opening, only the fast ones will come out, and when the opening is small only the slow ones will come out.

b) The speed of the tiny particles is not related to the speed of the air itself. Although the air is coming out slowly the speed of the tiny particles is great, and when the air is coming out fast the speed of the tiny particles is slow.

c) Not all particles are of the same size, smaller particles move faster than larger particles, smaller particles come out first than larger particles.

d) Not all particles are of the same size, smaller particles move faster than larger particles, becuase they have more room to move around, as all particles begin to come out, they have even more room to move around, thus they increase their speed.

6. Student C recalls going to a gym with only two exits, labeled W and N respectively. After the game, people arriving at exit W, which was very wide, could go through it without having to slow down and without touching themselves, but people approaching exit N, which was very narrow, had to slow down and some pushing occurred, because the people in front had not managed to get out. Persons doing so, had a much slower speed than the one they had when approaching exit N.

   How can student C relate this experience with the previous model to formulate an explanation of the experience of blowing air on the hand?

   a) Like the people, when the particles of air go toward the small opening, the larger ones push aside the smaller ones and manage to get out sooner.

   b) Like the people, when the particles of air go toward the small opening, they can not come out at the same time, thus collisions occur, the ones nearest the opening are hit from behind and thus come out very fast, resulting in the increase of speed of the air.

   c) Like the people, when the particles of air go toward the small opening, the smaller ones will manage to get out sooner.

   d) Like the people, when the particles of air go toward the small opening, they can not come out at the same time, thus collisions occur which slows them down, this decrease in speed ressults in the decrease of temperature.

7. In drawing a similarity between the tiny particles and the persons inside the gym, which one of the following conditions of the model of air "composed of tiny particles", is violated?

   a) The model requires the tiny particles not to collide between themselves.

   b) The model requies the tiny particles to be invisible to the eye.

   c) The model requires the tiny particles to be of the same size.

   d) The model requires the tiny particles to have equal mass.

ANALYSIS FORM FOR "ANAXIMENES' PROBLEM"

de ________

dent No., and Sex	STUDENTS ANSWERS TO NUMBERED QUESTIONS																													Ttl Score
	1	2				3				4				5				6				7								
	See Note	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D					

: For question 1 write down sequence obtained by student. For example, if the correct anwser was chosen, then write, "b, a, -, c."

IV. ATTITUDE DOMIAN (Preferences and Understandings)

This domian has, like creativity, often been neglected in both the construction of curricula and in the design of testing schemes. The attitude factors of science include the development of opinions toward school science, science teachers and science in general, and in the positive attitudes that students themselves generate upon exposure to scientific ideas. The purpose of this exercise is to assess how the students feel about science and their experiences in science courses so there are no right or wrong answers in the preferences part of this survey.

A. Notes to Teachers:

1. Please administer this test on an IBM-type answer sheet.

2. The students should be instructed to write their name or identification number in the appropriate space on the answer sheet and code in that response.

3. The students should answer each of the questions on the answer sheet provided, as shown below:

Example: Do you like to go to the movies?

A) YES B. NO C) I DON'T KNOW

If the student does not like to go to the movies, then the answer selected should be B. On the answer sheet, the choice for "B" would be filled in by fully darkening the circle with a pencil.

4. Please return all answer sheets to the Chautauqua Center, but be sure to save a copy of the pre-test results for later comparison with with post-test assessments.

5. Following your S/T/S unit, administer the same instrument as a post-test.

6. Send these post-tests and your analaysis sheet to the Chautauqua office as soon as possible. Be sure to include a summary of the results of the results when you compare the pre- and post-tests. Please make some general statments about growth seen within your students in the domain of attitude.

B. References:

The list below provides other examples of attitude tests which you might like to review:

1) Student Preferences and Understandsing (NAEP)
2) Scientific Attidue Scale (Moore)
3) Attitude Toward the Study of Science (Yager)
4) Test of Attitudes on Technology-Society Interaction (Piel)
5) Attitudes Toward Science and Technology (Temple University)

PREFERENCES AND UNDERSTANDINGS

STUDENT VERSION
(Revised October, 1987)

1. What is your favorite subject in school?
   A. language arts
   B. social studies
   C. mathematics
   D. science
   E. art
   F. physical education
   G. music
   H. foreign languages

2. What is your next (second) favorite subject?
   A. language arts
   B. social studies
   C. mathematics
   D. science
   E. art
   F. physical education
   G. music
   H. foreign languages

3. What is your least favorite subject in school?
   A. language arts
   B. social studies
   C. mathematics
   D. science
   E. art
   F. physical education
   G. music
   H. foreign languages

4. Do you wish you had more time for science classes in school?
   A. yes B. no C. I don't know

5. Do you wish you had more kinds of science courses to take?
   A. yes B. no C. I don't know

6. Which "kind" of science do you like best?
   A. science that is about living things
   B. science that emphasizes the physical world
   C. science that stresses the earth and the universe

7. Does your science teacher ask you many questions about science?
   A. yes B. no C. I don't know

8. Does your science teacher like for you to ask questions about science?
   A. yes B. no C. I don't know

9. Does your science teacher encourage you to give your own answers?
   A. yes B. no C. I don't know

10. Does your science teacher really like science him/herself?
    A. yes B. no C. I don't know

11. Does your teacher make studying science exciting?
    A. yes B. no C. I don't know

12. Does your teacher know much science?
    A. yes B. no C. I don't know

13. Does your science teacher admit to not knowing answers to your questions?
    A. yes B. no C. I don't know

14. Does your science class make you feel prepared to make decisions?
A. yes B. no C. I don't know

15. Is your science class fun?
A. yes B. no C. I don't know

16. Is your science class interesting?
A. yes B. no C. I don't know

17. Is your science class exciting?
A. yes B. no C. I don't know

18. Is your science class boring?
A. yes B. no C. I don't know

19. Does your science class make you feel uncomfortable?
A. yes B. no C. I don't know

20. Does your science class make you feel successful?
A. yes B. no C. I don't know

21. Does your science class make you feel curious?
A. yes B. no C. I don't know

22. Are the things you learn in science useful to you when you are not in school?
A. yes B. no C. I don't know

23. Do you think that knowing science will help you in the future?
A. yes B. no C. I don't know

24. Do you feel that the science you study is generally useful to you?
A. yes B. no C. I don't know

25. Do you feel that your study of science is useful in helping you to make choices?
A. yes B. no C. I don't know

26. Do you think that being a scientist would be fun?
A. yes B. no C. I don't know

27. Do you think that being a scientist would make you rich?
A. yes B. no C. I don't know

28. Do you think that being a scientist would be a lot of work?
A. yes B. no C. I don't know

29. Do you think that being a scientist would be boring for you?
A. yes B. no C. I don't know

30. Do you think that being a scientist would make you feel important?
A. yes B. no C. I don't know

31. Do you think that being a scientist would make you lonely?
A. yes B. no C. I don't know

32. Is science class difficult for you?
A. yes B. no C. I don't know

33. Do you use what you learn in science class outside of school?
A. yes B. no C. I don't know

34. Do you talk about science careers in science class?
A. yes B. no C. I don't know

35. Do you have fun trying to solve problems included in your science classes?
A. yes B. no C. I don't know

36. Do your parents ask you questions about what you do in science class?
A. yes B. no C. I don't know

37. Does technology effect your daily living?
A. yes B. no C. I don't know

38. Do you use information you learn in science in situations outside of school?
A. yes B. no C. I don't know

39. What do you think is the most important part of science?
A. knowing about your world
B. thinking through problems
C. being curious and exploring
D. explaining things you see
E. testing your ideas

40. Do you think it is important to plan experiments to test your own ideas to see if they are right or wrong?
A. yes B. no C. I don't know

Select the most complete definition or understanding of the following terms. If you do not know the answer or are not sure, answer "I don't know." This is not a test. Don't be concerned if you do not know some or all of these words. Do the best you can!

41. Volume
A. the size of the matter in three dimensions
B. the energy needed to produce movement
C. the size of an object expressed in numbers
D. the amount of space inside an object
E. the speed of a moving object
F. I don't know

42. Organism
    A. organic materials
    B. any living object
    C. the part of the human body that controls actions
    D. a very small form that is alive
    E. a form of chemistry
    F. I don't know

43. Motion
    A. the action that occurs during exercise
    B. a feature of animals
    C. a change in the position of an object
    D. the action that occurs in a human
    E. the movement of the earth in space
    F. I don't know

44. Energy
    A. what makes objects in a system interact
    B. the material in a system that has substance
    C. the force responsible for growth
    D. chemical changes in a living thing
    E. factor which controls weather
    F. I don't know

45. Molecule
    A. a form of energy that holds the world together
    B. a kind of organism that lives underground in the dark
    C. a chemical change that can produce new kinds of materials
    D. the structure of living forms that relate the world of life to the rest of the world
    E. the smallest unit of material that has the original features of the material
    F. I don't know

46. Cell
    A. the smallest building unit of living things
    B. the block where units are sorted out for study
    C. a unit of energy in a living form
    D. building blocks that enclose living forms
    E. microscopic blocks that enclose living forms
    F. I don't know

47. Enzyme
    A. a part of a cleaning compound
    B. a chemical that is involved in all change of matter
    C. a regent that helps maintain sterile conditions
    D. the agent responsible for the production of energy as a result of chemical changes
    E. large molecules which control all chemical changes in a living system
    F. I don't know

48. Fossil
   A. a hard part of living materials
   B. any evidence of past life
   C. animals embedded in rocks
   D. coal and other organic deposits in the earth
   E. testing the accuracy of explanations
   F. I don't know

V. APPLICATIONS DOMAIN

There are various ways in which scientists use the information and concepts they discover. This list certainly not complete, but includes the understanding of the principles found in familiar devices, understanding and evaluating reports of scientific discovery, making decisions which use scientifric ideas and, of course, genrally applying the knowledge gained from science.

A. Notes to Teachers

1. Please administer an applications test as a pre-test. You may use the sample provided here or use one of your own design.
2. Evaluate the student responses yourself. Please include an item analysis form when you respond to the Chautauqua office. This form should list the name (or identification number) of the students taking the test, and their individual responses to each question.
3. Be sure to save a copy of the pre-test results for later comparison with the post-tests.
4. Following your S/T/S unit, adminster another applications assessment as a post-test.

B. References:

1) Science and Society (Dagher)
2) Views on Science-Technology-Society (Korth)
3) STS Examination Items for Science in a Social Context (ASE)

APPLYING SCIENCE CONCEPTS

1. If a given amount of water freezes, its volume increases. Which one of the following is the main reason that water should not be stored in the freezer in totally filled glass containers?

   a) The taste of the water will change.

   b) The glass containers will break.

   c) The water reacts with the glass at very low temperatures.

   d) Water will not freeze because there is not enough space available to convert into ice.

2. The time it takes to warm an immersed object in a boiling liquid depends on the mass of the object and how much surface is exposed to the boiling liquid. For two objects made of the same substance, and of equal mass, the one with more surface will become warm in less time.

   According to this which of the following will cook the slowest in boiling water?

   a) A one pound potato.

   b) One pound of small potatoes.

   c) One pound of medium potatoes.

   d) One pound of potatoes cut into small pieces.

3. If you were in a stalled elevator in a tall building, which would be best for you to do while waiting to be rescued?

   a) Take deep breaths.

   b) Sit on the floor.

   c) Stand quietly.

   d) Pound on the door.

4. If there were no heat in your house and the temperature were -15 degrees C, what would you do to keep warm until there is heat?

   a) Dress warmly and sit quietly.

   b) Dress warmly and move about.

   c) Eat soup.

   d) Exercise constantly.

5. In a particular region of Canada, a number of coniferous trees are losing an excessive number of needles. Which of the following would be a likely explanation?

   a) Great temperature variation.

   b) A parasitic infestation.

   c) Approach of winter.

   d) Too much stored food.

6. While sitting at the breakfast table on a clear winter morning, you notice at the bird feeder what seems to be a species you have never seen before. This bird seems nervous and destined to fly away quickly. What steps would you recommend to best guarantee being able to identify the bird with the aid of a bird guide?

   a) Note favorite food the bird chooses.

   b) Observe the behavior of the bird.

   c) Carefully study size and coloration.

   d) Determine sex of the bird.

7. The temperature at which water boils decreases with altitude.

   A pressure cooker is a kitchen appliance where high pressure and high temperature are maintained inside the cooker.

   Where would it be more useful to have a pressure cooker for cooking food?

   a) At sea level.

   b) High up in the mountains.

   c) Below sea level.

   d) A mile above sea level.

8. Evaporation is a cooling process. Out on a camping trip, which of the following situations would result in providing the coldest water if they all started with water at the same temperature?

   a) Metal canteen kept in the shade.

   b) Metal canteen with cloth covered sides soaked with water and kept in the shade.

   c) Metal canteen immersed in a bucket of water at same temperature as interior water and kept in the shade.

   d) Metal canteen kept in direct sunlight.

9. Light colored objects reflect sunlight better than dark colored objects.

During a sunny winter day, which vehicle would be the warmest to the touch?

a) A blue car.

b) A red car.

c) A white car.

d) A black car.

10. At zero and below zero weather conditions up to 80 percent of the heat generated by the body can be lost through the surface of the head and neck.

While out in a camping trip in fair weather and wearing boots, shorts, t-shirt and light jacket, below zero-conditions set in.

Which would be the best way to preserve the most of your body heat?

a) Wrap the jacket around the uncovered portion of your legs.

b) Leave the jacket on as you usually wear it.

c) Wrap the jacket around your head and neck.

d) Use the jacket to keep the nearby air moving.

11. Mary went to her driving license exam. One of the written questions deals with the amount of distance needed to stop a moving car. It is known that a certain car with a speed of 25 miles per hour needs a braking distance of 50 feet. Also, the braking distance is directly proportional to the kinetic energy of the moving car, and the kinetic energy is directly proportional to the square of the speed, if the car doubles its speed, how large is the new braking distance compared to the previous distance?

a) Two times as much.

b) Four times as much.

c) Eight times as much.

d) Ten times as much.

12. If the surrounding temperature is lower, warm objects made of the same substance and at the same temperature cool down in proportion to their exposed area.

After the waiter brings your cooked steak, which is the best way to keep it as warm as possible while you eat it?

a) Cut only the piece to be eaten.

b) Cut steak quickly into mouth-size pieces.

c) Keep air moving near the steak.

d) Eat slowly.

13. Warm blooded animals lose body heat in proportion to their area and generate it in proportion to their weight. According to this, which animal would need to eat more per bodyweight?

a) A mouse.

b) A dog.

c) A cow.

d) A cat.

14. When most metal objects are heated, they increase in size. When you can not turn the metallic lid screwed on a glass container and put it under warm running water to loosen it, what are you taking for granted?

a) Both glass and lid increase in size in the same proportion.

b) Glass increases in size in a greater proportion than the lid.

c) The lid increases in size in a greater proportion than the glass.

d) Glass and metal do not stick together as much in water.

15. If a nickel with a hole in it is heated, what will happen to the hole?

a) Decrease in size.

b) Stay the same.

c) Increase in size.

d) Become irregular.

16. When water boils, its steam has the same temperature as the boiling water, but it has stored energy that it will liberate upon condensing into water.

With this in mind, which of the following will be more harmful?

a) A burn with boiling water.

b) A burn with steam.

c) A burn from condensed water.

d) A burn from heated rain water.

17. Water is a substance that can absorb great amounts of heat while not greatly changing its temperature in relation to other substances or materials.

What could this situation help explain?

a) Why lakes freeze from the top down.

b) Why ice floats in water.

c) Why cities which built along large bodies of water like lakes or the sea have moderate climate in relation to other cities along the same latitude.

d) Why ice is so prevalent at both the North and South Poles.

18. Objects reflect certain kinds of light which in turn produces certain colors. Which of the following best explains why most plants are green?

a) A substance which reflects green light is a major constituent.

b) Green light is used by the plant.

c) Only green light is absorbed by most plants.

d) All light except for the green light affects plant growth.

19. Light is detrimental to the growth of most living things. Why then is light necessary for life to exist?

a) Light prevents death caused by unlimited growth.

b) Light stimulates the formation of specific chemicals in the living system.

c) Light slows the aging process and thereby enables reproduction to occur.

d) Light is necessary for other activities which occur in living things.

20. Lineville had a population of 10,000 in 1980. It has been losing people at the rate of 1% per year. What would you anticipate the population will be in 1990?

a) Approximately 5,000.

b) Approximately 7,000.

c) Approximately 9,000.

d) Approximately 11,000.

21. Reducing air pollution is a major goal in our society. Passing laws to slow or to eliminate such pollution have not occurred swiftly. Which of the following illustrates one reason?

a) The causes of air pollution arise from situations which are vital for other aspects of living.

b) Many of the causes of air pollution can not be regulated by laws.

c) Decreasing air pollution usually produces other kinds of pollution which results in more pollution than the current situation.

d) Most air pollution results from factors which can not be altered.

22. Room temperatures often change in public buildings during a 24 hour period. Which of the following is the least likely to be a cause?

a) Thermostat settings.

b) Changes in outside temperatures.

c) Number of people going in and out of the room.

d) The size of the heating source.

23. Leaves are often dropped from plants which do not loose their leaves during the winter. What does this suggest concerning leaf loss?

a) Leaf loss is important for plant survival in ways other than protection from adverse temperatures.

b) Leaf loss is a part of the aging process.

c) Leaf loss includes a regulation of chemical reactions which is accomplished at times other than winter.

d) Leaf loss is related to soil types.

24. Which kind of water would provide the best habitat for growing water plants?

   a) Still water full of decaying matter.

   b) Still water that is relatively clear.

   c) Moving water that includes other living things.

   d) Moving water that is free of debris.

25. Radiation is known to affect living cells adversely. Which of the following would be a desirable precaution regarding a work place where radiation is used as a tool?

   a) Remain near radiation source for short periods of time.

   b) Cover the body with materials that halt radioactive rays reaching living cells.

   c) Point radioactive materials away from the body.

   d) Alternate the days of exposure with other workers.

26. If you lived in a house with a couple of big windows on the south side and if the house were located in the upper midwest of the U. S., which of the following would help the house be more energy efficient?

   a) Deciduous (maple) trees being located on the south side.

   b) Coniferous (spruce) trees being located on the south side.

   c) Plant low plants near the foundation on the south side.

   d) Have no trees on the south side.

27. Which of the following would again be best for energy effieiency using the same house mentioned in question 26, but dealing instead with the north side of the house instead (which has a couple of small windows)?

   a) Deciduous (maple) trees being located on the north side.

   b) Coniferous (spruce) trees being located on the north side.

   c) Plant low plants near the foundation on the north side.

   d) Have no trees on the north side.

28. For question 26 what was the important reason for choosing the answer you did?

    a) The wind break potential of the coniferous trees.

    b) The deciduous tree's characteristic of shading well in the summer and not as well in the winter.

    c) The low plants are good sources of shade to cool the basement of the house.

    d) No trees would let lots of sunshine reach the house.

29. For question 27 what was the important reason for choosing the answer you did?

    a) The wind break potential of the coniferous trees.

    b) The deciduous tree's characteristic of shading well in the summer and not as well in the winter.

    c) The low plants are good sources of shade to cool the basement of the house.

    d) No trees would let lots of sunshine reach the house.

30. Recycling aluminum cans is a good habit to get into for all people because:

    a) People like to return things.

    b) The metal, aluminum, is not going to last forever so by recycling it, the aluminum will last longer.

    c) The metal, aluminum, is easily broken down when buried underground and will make groundwater poisonous.

    d) I don't agree that recycling aluminum is a good habit.

CORRECT ANSWERS FOR
"APPLYING SCIENCE CONCEPTS"

1. B
2. A
3. B
4. B
5. B
6. C
7. B (If mountains are a mile above sea level)
8. B
9. D
10. C
11. B
12. A
13. A
14. C
15. C
16. B
17. C
18. A
19. B
20. C
21. B
22. A
23. B
24. A
25. B
26. A
27. B
28. B
29. A
30. B

SCIENCE AND SOCIETY

DIRECTIONS

This questionnaire is asking you about how you feel about certain things and what you do at certain times. There are no right or wrong answers to these questions. The way you feel or the things you do are the right answers for you.

Record your answer to each of the questions on the response sheet provided. Please make no marks on this booklet. Answer every question. As you do so, go through the following steps:

- Read the statement carefully.
- Think about how well the statement describes your feelings or behavior.
- Find the number on the Response sheet that corresponds to the statement you are considering.
- Using a pencil, answer the statement by filling in the circle, as shown in the example:

SECTION A
1. I enjoy going to the movies.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

If you enjoy going to the movies sometimes then 2 is the right answer for you.

On the Answer sheet then, first find SECTION A, and then number 1. Darken completely with your pencil the circle which has the number that corresponds to your choice. In this example it should be:

SECTION A	SECTION B	SECTION C	SECTION D	SECTION E
A B C D E	A B C D E	A B C D E	A B C D E	A B C D E
1 ① ● ③ ④ ⑤	1 ① ② ③ ④ ⑤	1 ① ② ③ ④ ⑤	1 ① ② ③ ④ ⑤	1 ① ② ③ ④ ⑤
A B C D E	A B C D E	A B C D E	A B C D E	A B C D E
2 ① ② ③ ④ ⑤	2 ① ② ③ ④ ⑤	2 ① ② ③ ④ ⑤	2 ① ② ③ ④ ⑤	2 ① ② ③ ④

Please note: Each time the section changes you mark answers in that section beginning with number 1. Section A has 9 items only, Section B has 7 items only, etc.

Write this information in the following spaces on top of the Answer Sheet:
Instructor Your teacher's name
Dept grade level
Course six

SECTION A

DO YOU FEEL YOU CAN DO ANYTHING ABOUT THE FOLLOWING PROBLEMS?

1. I can do something about pollution.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

2. I can do something about energy waste.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

3. I can do something about food shortages.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

4. I can do something about overpopulation.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

5. I can do something about diseases.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

6. I can do something about running out of natural resources.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

7. I can do something about hazardous waste.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

8. I can do something about running out of lean, fresh water.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

9. I can do something about the nuclear arms race.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

SECTION B

WHICH OF THE FOLLOWING WOULD YOU BE WILLING TO DO TO HELP SOLVE WORLD PROBLEMS, EVEN IF IT IS INCONVENIENT?

1. I would be willing to use less electricity.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

2. I would be willing to walk and ride bikes more often.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

3. I would be willing to spend a day helping clean up litter from a street, park, or road.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

4. I would be willing to separate trash (bottles, cans, paper, etc.) for recycling.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

5. I would be willing to drive or ride in a small economy car.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

6. I would be willing to use less heat in the winter to save fuel.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

7. I would be willing to use returnable bottles rather than "throw away" bottles.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

SECTION C

FOR EACH OF THE FOLLOWING QUESTIONS, TELL HOW OFTEN YOU DO THESE THINGS:

1. How often do you try your ideas to see if they work?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

2. How often do you believe what you read in books about science?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

3. How often do you check your school work to see if it is accurate?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

4. How often do you read the labels when you are trying to decide whether or not to buy a product?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

5. How often do you think it is important to look at all sides of the question before you make a decision?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

6. How often do you believe there are logical explanations for things you see happen?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

7. How often do you prefer being told an answer rather than having to find out that answer on your own?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

8. How often do you like to try to figure out how things work?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

9. How often do you change your mind when you find out that your ideas do not fit the facts?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

10. How often do you keep working on a task even when you find out that your ideas do not fit the facts?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

11. How often do you keep working on a task even if you run into problems that you do not expect?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

12. How often do you feel you have wasted your time when you try a new idea and find that it does not work?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

13. How often do you gather a variety of information before you make a decision?

Always	Often	Sometimes	Seldom	Never
1	2	3	4	5

SECTION D

HOW OFTEN HAVE YOU TRIED TO DO THE FOLLOWING THINGS?

1. I have tried to fix something electrical.

Many times	Not very often, but more than twice	Once or twice	Never
1	2	3	4

2. I have tried to fix something mechanical.

Many times	Not very often, but more than twice	Once or twice	Never
1	2	3	4

3. I have tried to figure out what is wrong with an unhealthy plant.

Many times	Not very often, but more than twice	Once or twice	Never
1	2	3	4

4. I have tried to figure out what is wrong with an unhealthy animal.

Many times	Not very often, but more than twice	Once or twice	Never
1	2	3	4

SECTION E

COULD THE THINGS YOU HAVE LEARNED IN SCIENCE CLASSES HELP YOU IF YOU WERE DOING THE FOLLOWING THINGS:

1. I have learned things that would help me drive a car.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

2. I have learned things that would help me cook.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

3. I have learned things that would help me repair a lamp.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

4. I have learned things that would help me decide who to vote for in the city council.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

5. I have learned things that would help me decide what exercises to do to stay healthy.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

6. I have learned things that would help me decide on snacks.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

7. I have learned things that would help me prepare a menu.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

8. I have learned things that would help me when buying soap.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	2	3	4	5

9. I have learned things that would help me choose friends.

Definitely yes	Sometimes yes	Not sure	Sometimes not	Definitely not
1	2	3	4	5

10. I have learned things that would help me fix my bike.

Definitely yes	Sometimes yes	Not sure	Sometimes no	Definitely no
1	3	3	4	5